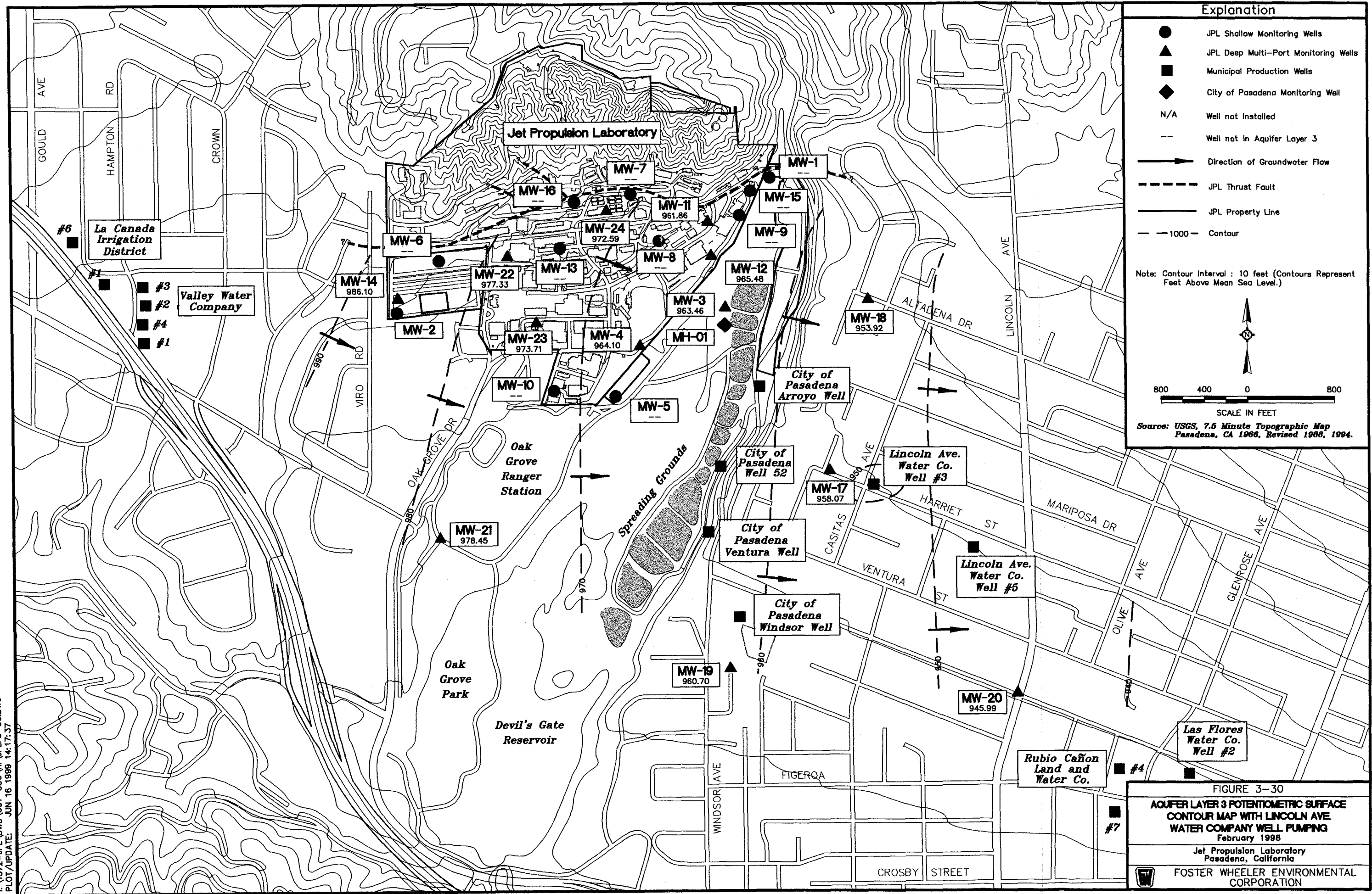
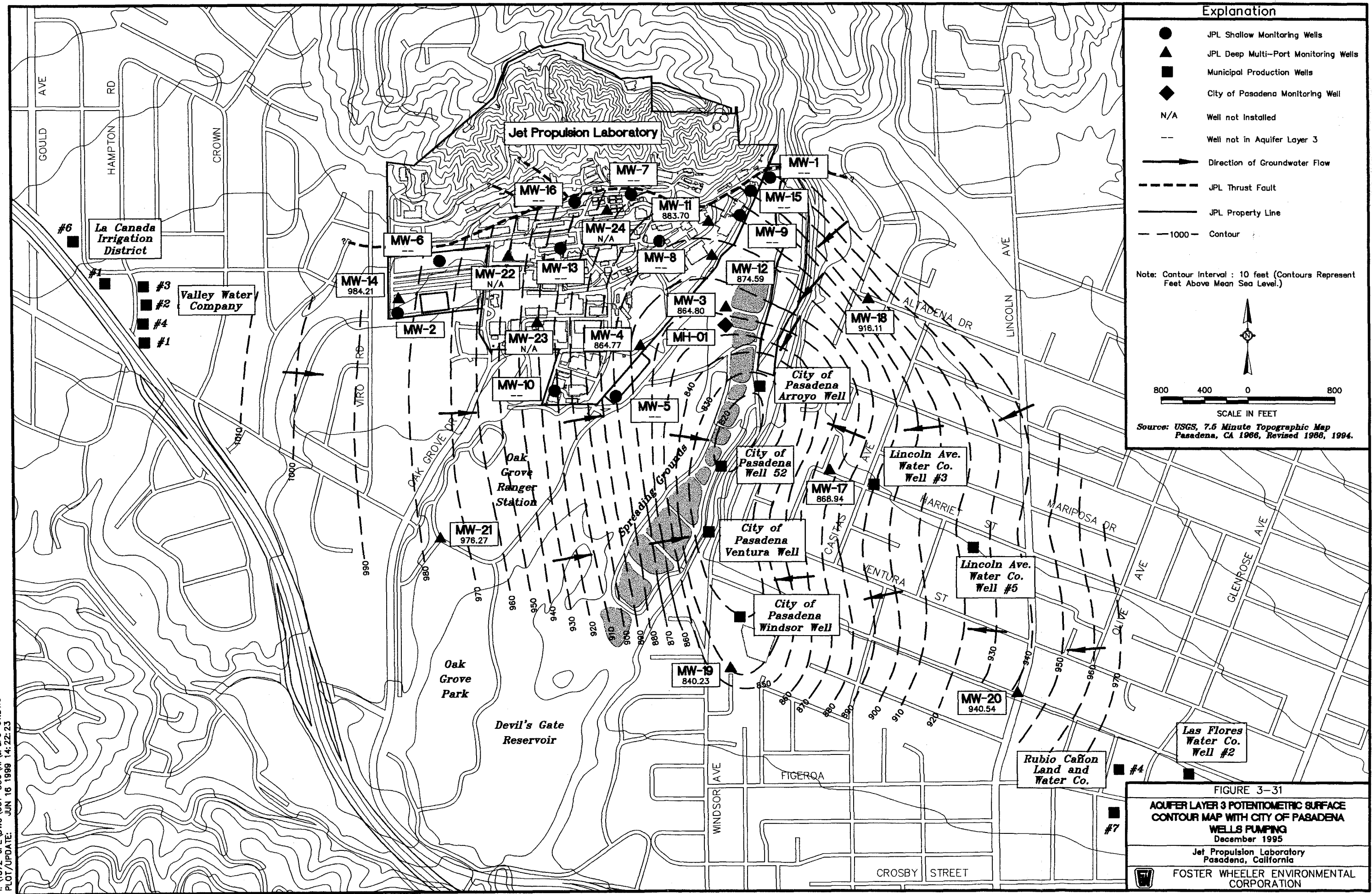


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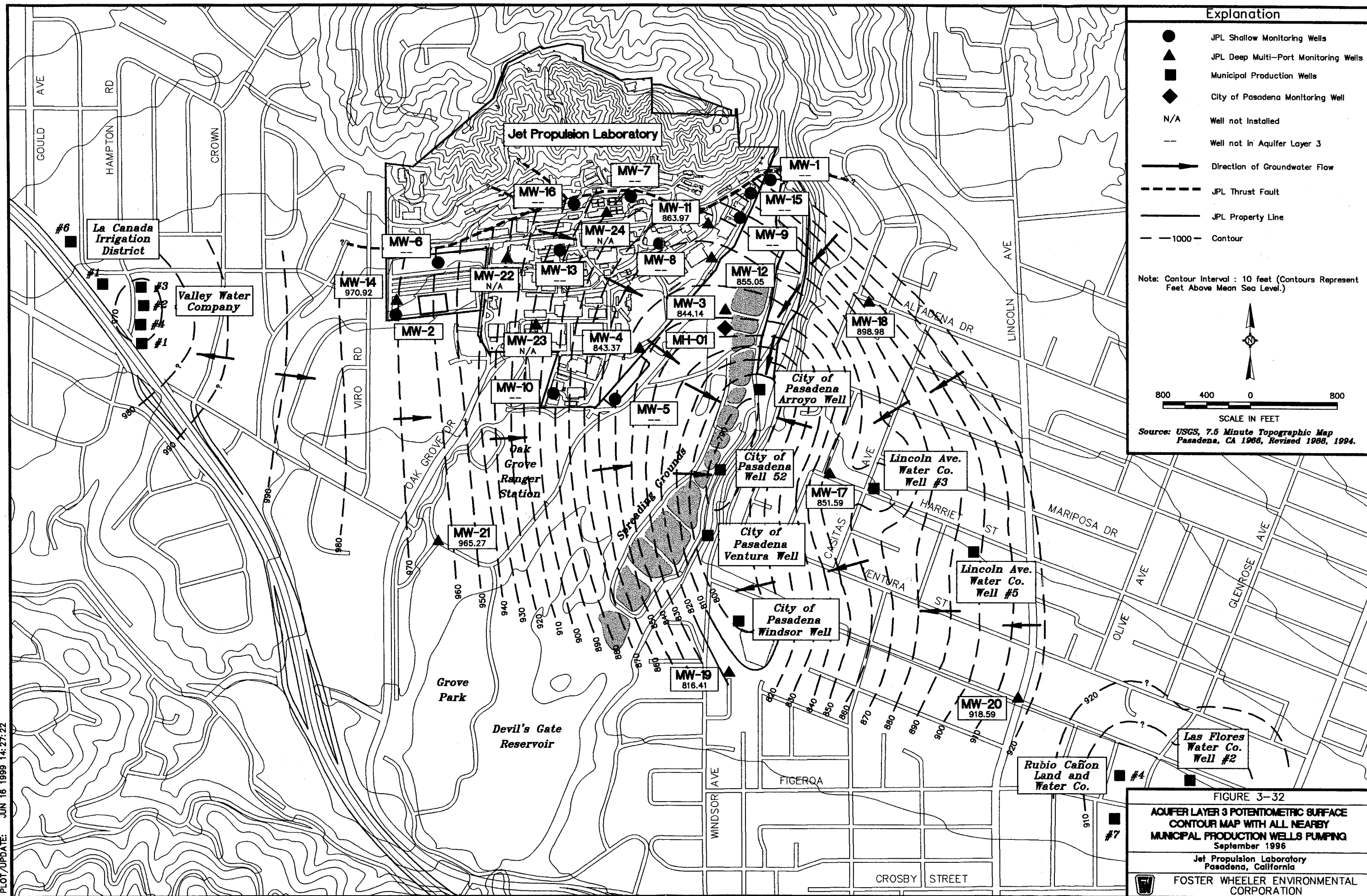
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4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination in on-site and off-site groundwater is summarized in this section. Groundwater data collected from JPL groundwater monitoring wells and off-site municipal water production wells have been used in defining the nature and extent of contamination. Well locations are shown on Figure 2-1. In addition, information that would be relevant for fate and transport studies, baseline health risk assessment, and an FS has been included.

Following is a brief summary of the wells, both monitoring and production, from which data was used for the RI:

Well Type	Well Numbers
OU-1 JPL Monitoring Wells	MW-1, MW-3 through -16 and MW-22 through 24
OU-3 JPL Monitoring Wells	MW-17 through -21
City of Pasadena Production Wells	Arroyo Well, Well 52, Ventura Well, Windsor Well
City of Pasadena Monitoring Well	Well MH-01
Lincoln Ave. Water Co. Production Wells	Well #3 and Well #5
Rubio Cañon Land & Water Co. Production Wells	Well #4 and Well #7
Valley Water Co. Production Wells	Well #1, Well #2, Well #3, and Well #4
La Canada Irrigation District Production Wells	Well #1 and Well #6
Las Flores Water Co. Production Wells	Well #2

The JPL monitoring wells are the primary sources of groundwater quality information in defining the nature and extent of contamination. Data from these wells have been collected over a number of groundwater sampling events (generally quarterly), conducted since 1994. As will be discussed later, each sampling event consisted of collecting groundwater samples from JPL monitoring wells, and analyzing for various constituents (not all of the monitoring wells were sampled during every event because some wells were added after the sampling program had been initiated).

Groundwater quality data from the nearby municipal production wells were obtained from the California Department of Health Services (CA DHS) database and Bookman-Edmonston Engineering, a consulting firm providing services for the Raymond Basin Management Board. The actual concentrations reported from the nearby production wells were generally not considered usable in contouring contamination because the sampling techniques and analytical protocols used are largely unknown, or are believed to be inconsistent with those normally employed in a CERCLA investigation. However, such data have been used to support or substantiate the RI data presented in the contaminant contour maps and substantiate the estimated extent of contamination. This is explained in detail in Section 4.1.3.

4.1 BACKGROUND INFORMATION

As mentioned earlier, groundwater chemical data were collected from JPL groundwater monitoring wells and from nearby municipal production wells. With regard to groundwater flow regimes beneath the site and adjacent area, water-level data were obtained from JPL monitoring wells and used to plot water-level and hydraulic head contour maps to establish overall flow patterns and to ascertain how pumping of the nearby production wells influences the flow directions (Section 3.4.3). In addition, local municipal water companies are known to periodically inject water obtained from other sources into their wells, or divert it to spreading basins (recharge basins) for purposes of recharging the aquifer. These practices may have potentially affected the chemical composition of the groundwater. The types of data collected, frequency, and collection methodology are described below

4.1.1 OU-1 Groundwater Monitoring Wells

To assess the distribution of groundwater contamination underneath JPL, eighteen monitoring wells were installed for OU-1 and routinely sampled. The wells include MW-1, MW-3 through MW-16, MW-22, MW-23, and MW-24, as shown on Figure 2-1. Well MW-2 was replaced as a sampling point with well MW-14. Well construction details for these wells are presented in Section 2.1. Ten of the JPL wells (MW-1, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-13, MW-15, MW-16) are relatively shallow standpipe wells, with a single screened interval. The remaining eight wells (MW-3, MW-4, MW-11, MW-12, MW-14, MW-22, MW-23, MW-24) are deep multi-port wells each with five screened intervals at various depths. All groundwater sampling procedures used during the RI, including field quality control procedures, are summarized in Section 2.2.

RI sampling of OU-1 wells MW-1 and MW-3 to MW-16 (15 wells total) commenced in 1994, with the first two RI events in June/July, 1994 and November/December, 1994. During the first two RI events, only the OU-1 wells were sampled, since the OU-3 wells had not yet been installed. The OU-1 wells were sampled again, concurrently with the OU-3 wells, when a long-term quarterly monitoring program began in August 1996. During the long-term monitoring program, the OU-1 wells were sampled in 1996 (August/September and October/November), 1997 (February/March, June/July, and September/October), and 1998 (January/February). Beginning with the September/October 1997 event, the three newly installed OU-1 wells, MW-22, MW-23, and MW-24 were also sampled (for a total of eighteen OU-1 wells). Table 4-1 presents a summary of the different RI sampling events, and the various constituents analyzed at each event. All groundwater samples were analyzed by Montgomery Watson Laboratories located in Pasadena, California, using EPA CLP level IV protocols for a variety of inorganic and organic compounds. As shown in Table 4-1, comprehensive suites of analyses were performed in the initial two RI events (June/July, 1994 and November/December, 1994) to identify potential constituents of concern, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Title 26 metals, other metals, cyanide, gross alpha/gross beta, and total petroleum hydrocarbons (TPH). In later events, various analyses were added or dropped based on

previous results, or new information. Specific elements/compounds included in analyses conducted during the RI are listed in Table 4-2.

As part of the monitoring program, groundwater samples were also submitted for analysis of general mineral parameters including major cations and anions (Section 3.4.2). These analyses were performed in order to further understand the natural chemistry of the groundwater beneath JPL and for potential use in interpreting groundwater flow patterns. For a summary of all analyses performed at each event, refer to Tables 4-1 and 4-2.

In addition to groundwater sampling, water levels were measured in the JPL monitoring wells on a regular basis (see Section 3.4.3). Water levels in the OU-1 shallow monitoring wells were measured daily using dedicated transducers and data logging equipment which stores water-level information electronically. The water-level data were retrieved from the data loggers on a monthly basis. Water levels in the deep, multi-port wells were monitored manually each month using a pressure-transducer probe manufactured by Westbay specifically for the unique casing in these wells. For a detailed discussion of water level monitoring procedures, see Section 2.6.

4.1.2 OU-3 Groundwater Monitoring Wells

OU-3 JPL wells MW-17 through MW-20 were installed to assess contaminant migration into groundwater located down-gradient from JPL. Off-site well MW-21 was installed in Oak Grove Park, south of JPL, to evaluate potential contaminant migration from unknown up-gradient sources in La Canada/Flintridge. Following their installation in 1995, the OU-3 wells were sampled twice (July/August 1995 and December/January 1995-96), and samples were submitted for large suites of analyses that included VOCs, SVOCs, Title 26 metals (filtered and unfiltered), and cyanide to identify potential constituents of concern. The OU-1 wells were not sampled during these two events since the OU-1 investigation was separate from the OU-3 investigation at that time. In August, 1996, after these two initial rounds were completed, the long-term quarterly groundwater monitoring program began at JPL that included sampling of both OU-1 and OU-3 wells. During the RI period, six long-term quarterly sampling events have been completed. The data from these six quarterly monitoring events is the major focus of this RI report, since for each event, data was obtained from both OU-1 and OU-3 wells simultaneously. The long-term quarterly sampling events were completed in August/September 1996, October/November 1996, February/March 1997, June/July, 1997, September/October 1997, and January/February, 1998. Because many of the constituents initially analyzed for were not detected, or were detected sporadically at concentrations well below regulatory limits, the suite of analyses performed during the long-term quarterly monitoring events was reduced to include VOCs and selected metals (arsenic [As], lead [Pb], and chromium [Cr]; analyses for Cr included both total Cr and hexavalent Cr [Cr(VI)]), with approval from the regulatory agencies (EPA, DTSC, and RWQCB). In addition, during the last three long-term quarterly events, analyses for perchlorate (ClO_4^-) were also carried out.

Samples were also analyzed for the same general water chemistry parameters as the OU-1 wells (Section 3.4.2). Water-level measurements for OU-3 wells were taken in the same manner as for the OU-1 multi-port wells (discussed in Section 2.6).

4.1.3 Municipal Production Wells

As shown in Figure 2-1, a number of municipal production wells are present off-site, both down-gradient of JPL (City of Pasadena, Lincoln Avenue Water Company, Rubio Cañon Land and Water Company, Las Flores Water Company) and up-gradient of JPL (La Canada Irrigation District and Valley Water Company). Details of municipal production well construction are given in Table 3-8. Three types of data were obtained regarding the production wells:

- Production data - monthly quantities of groundwater produced (Figure 3-19).
- Groundwater recharge data - monthly quantities discharged to the Arroyo Seco spreading basins and monthly quantities injected into the Valley Water Company wells (Figure 4-1).
- Chemical data - concentrations of contaminants of interest (Tables 4-3 and 4-4, and Figure 4-2).

The groundwater production data obtained will have a direct bearing on the evaluation of potential remedial alternatives in the preparation of the FS, particularly for alternatives that include well-head treatment as a remedial technology. In the same manner, chemical data from production wells, along with contaminant contour maps based on JPL monitoring wells, will allow for evaluation of the effectiveness of (a) existing production wells to adequately contain contaminant plumes, and (b) current and/or future well-head treatment in treating produced water.

As mentioned above (see Section 4.0), chemical data from the production wells were generally used to corroborate existing RI data, and, due to sampling protocol, were not considered usable as contour points to define the nature and extent of contamination (except in certain, limited instances as explained below). There are a number of reasons for this approach. Firstly, analyses of production well samples were performed on water that had been extracted by the production well pumps, which subjects the water to considerable vacuums and turbulence. This prevents results from being representative of the groundwater quality at the sampling location, particularly with respect to VOCs. Actual sampling procedures and field QA/QC can not be verified. In addition, JPL monitoring wells generally represent discreet sampling points at known depths (see Section 2.1), which allows for vertical characterization of the extent of contamination in various aquifer layers (see Section 4.2.1). Since municipal production wells are screened over several hundreds of feet, mixing and dilution occurs and the reported concentrations can not be relied upon. Finally, Montgomery Watson Laboratories was used exclusively throughout the RI monitoring program, and was audited twice during the RI by Foster Wheeler and JPL personnel to ensure uniformity of analytical procedures and results (Section 4.4). Sources of the production well data include at least three laboratories (Grazyna Newton, CA DHS, personal

communication, June 9, 1998), and because analytical, QA/QC, and validation procedures can not be reviewed, uniformity of these results with Foster Wheeler RI results can not be assumed.

Because (as explained, previous paragraph), volatilization (VOCs only) and dilution (VOCs and ClO_4^-) have likely occurred during production well sampling, it is conservatively assumed for this report that contaminant concentrations measured in production wells probably do not represent actual plume concentrations. Although production well data were generally not used as contour points, there were instances where the contaminant concentrations in a production well exceeded concentrations measured in nearby JPL monitoring wells. In an effort to present all data as accurately as possible while taking into account the limitations of the production well data, these higher concentrations were contoured in these instances to convey the plume as completely as possible. It is stressed however, that the contours based on the production well data are rough estimates and unverifiable.

Water levels have also historically been measured in the production wells. Generally, these data could not be used in this report. The reason for excluding most of these data is that these measurements are most often taken while the pumps are in operation, and therefore, subject to considerable error.

4.1.4 Hydrogeological Data

As mentioned earlier, extensive water-level data have been collected from on-site and off-site groundwater monitoring wells. The pumping of the off-site production wells along with the periodic recharge of the aquifer via spreading grounds result in very dynamic and complex groundwater flow patterns. The flow dynamics are even further complicated due to the annual shutdown of some of the pumping wells.

The hydrogeological data is discussed in detail in Section 3.4.3. A brief summary of groundwater elevations/flow patterns with emphasis on nature and extent of contamination and for use in the feasibility study is presented here.

Natural groundwater flow patterns for JPL and the surrounding area are predominantly to the southeast (Section 3.4.3). From the analysis in Section 3.4.3, it became clear that the City of Pasadena production wells profoundly influence groundwater flow patterns beneath JPL, and that influence from the other nearby municipal production wells is minimal, and not generally significant to the JPL site (Section 3.4.3). Therefore, two general conditions can be expected to occur in the study area that primarily influence the nature and extent of JPL contamination:

1. Periods of time when City of Pasadena production wells are operating.
2. Periods of time when City of Pasadena production wells are not operating.

Comparing flow patterns for the above two conditions in this report would help in evaluating alternatives in the FS that depend on the pumping of the nearby production wells (coupled with well-head treatment) as a potential remedial technology. It should be noted that the above

conditions represent the most prevalent scenarios. The flow patterns for each of the above site conditions are described below.

Condition No. 1 - City Of Pasadena Production Wells Operating

This regime can be expected to occur over the greater part of each year (up to 11 months, see Figure 3-19 [pumping data]). The typical flow patterns for such a condition are shown in Figures 3-21, 3-26 and 3-31 for various aquifer layer depths. As can be expected, the pumping of the City of Pasadena wells causes a significant zone of depression, drawing groundwater toward the wells both horizontally, and vertically. This condition is by far the most common and most important in understanding the nature and extent of contamination around JPL.

Condition No. 2 - City Of Pasadena Production Wells Not Operating

This regime can be expected to occur infrequently during the year. During the winter season, the City of Pasadena wells are typically shut down primarily for maintenance purposes. This usually lasts for approximately one month per year, however, the length of time may vary from year to year. The flow patterns for such a condition are shown in Figures 3-24 and 3-29 at various aquifer layer depths. Depending on the aquifer layers and the amount of groundwater recharge at the time, flow directions may be significantly different than during the period of time when the pumps are on (Section 3.4.3).

4.1.4 General Water Chemistry

As part of the groundwater monitoring program, groundwater samples were submitted for analysis of general mineral parameters. These included major cations and anions, total dissolved solids (TDS), and pH. These analyses were performed in order to further understand the natural chemistry of the groundwater beneath JPL and for potential use in interpreting groundwater flow patterns. For a list of the cations and anions included in these analyses, refer to Table 4-2. General groundwater chemistry data for each monitoring event are presented in respective quarterly long-term monitoring reports (Foster Wheeler, 1996f; 1997a,b,c; 1998a,b), and are summarized as Stiff diagrams in Appendix E. Several QA/QC checks were performed to determine that the data are acceptable for its intended use (anion/cation balance and calculated versus measured total dissolved solids) (Section 3.4.2).

The water chemistry results were compiled as Stiff diagrams, which allowed for a general empirical classification of each sample. This analysis has suggested that the majority of groundwater sampled at JPL can be classified as one of three general water types, based on the predominant cation and anion(s). These types include:

Water Type 1 Calcium-bicarbonate groundwater: Ca^{2+} as the dominant cation and HCO_3^- as the dominant anion;

Water Type 2 Sodium-bicarbonate groundwater: Na^+ as the dominant cation and HCO_3^- as the dominant anion;

Water Type 3 Calcium-bicarbonate/chloride/sulfate groundwater: Ca^{2+} as the dominant cation and HCO_3^- as the dominant anion, but with relatively elevated Cl^- and SO_4^{2-} concentrations.

The observed water types are discussed in detail in Section 3.4.2 of this report. In this section, areas in which the various water types occur are delineated graphically and used in characterization of contaminants where appropriate (Section 4.2, below).

4.1.5 Injection Wells/Recharge Basins

As mentioned above, aquifer recharge by local water purveyors occurs via injection or diversion of surface water from other sources into recharge basins. Most of the recharge basins in the Raymond Basin are located far enough from the JPL site, such that there is no effect on JPL groundwater quality and/or flow. However, there are two instances where the effects of recharge merit consideration. The first is the Arroyo Seco spreading grounds, which are located between JPL and the City of Pasadena municipal production wells (see Figure 2-1). These basins are flooded with surface water during the rainy season each year in order to recharge the aquifer, which when coupled with periods of time when the wells are not pumping, can have a significant effect on groundwater flow patterns. In addition, the Valley Water Company has for years been injecting water into their production wells during periods of non-pumping. These wells are located up-gradient from JPL. Because reported injection volumes are generally small, they are not likely to affect flow directions. However, the quality of the water injected can influence the water quality in downgradient wells. Volumes of water injected into the Valley Water Company wells, and volumes of water diverted to the Arroyo Seco spreading grounds over the period of January, 1994 through March, 1998 are shown in Figure 4-1.

4.2 RESULTS

This section includes a summary of the chemical data pertaining to the nature and extent of contaminants detected in the JPL groundwater monitoring wells, supplemented by municipal production well chemical data, groundwater recharge data and groundwater flow patterns. Complete analytical reports for the RI sampling events are included in Appendix G.

For the purposes of this report, the California Environmental Protection Agency maximum concentration limits (CA MCLs), which are equal to or more stringent than corresponding federal limits for each contaminant discussed herein, will be used as the reference MCL. In the case of analytes for which no CA MCL exists, the nearest equivalent will be defined and referred to. Also, sampling events were generally conducted over periods spanning approximately 5 weeks, and will be referred to herein by both months during which the event took place (i.e. January/February, 1998).

Furthermore, to facilitate three-dimensional assessment of the analytical results, the aquifer beneath the study area was divided into four "aquifer layers" based on the lithologic cross-sections presented in Figures 3-3 through 3-7. See Section 3.3 for a more detailed discussion on

how the individual "aquifer layers" were chosen and how the geologic cross sections were prepared. For the remainder of this section, these "layers" will be referred to as Aquifer Layers 1, 2, 3, and 4, respectively (moving from the uppermost to the deepest layer). Presented in Table 4-5 is a summary of the correlation between the aquifer layers beneath the study area and the well screens of multiple screened monitoring wells (the screened intervals for all of the shallow wells are located in the uppermost aquifer layer, Aquifer Layer 1). As noted, only one well screen (MW-20 Screen 5) is located in Aquifer Layer 4. Because contaminants have not been detected in MW-20 Screen 5 during the RI, Aquifer Layer 4 is excluded from this discussion.

Finally, as was noted above, in collecting and reviewing the various data for this report, it became apparent that pumping by the Pasadena municipal production wells exerted considerable influence on the groundwater flow beneath the study area. Therefore, attempts were made to correlate water-level data recorded from JPL monitoring wells with the monthly pumping volumes provided by the individual water purveyors to try to estimate periods of time that the pumps were either operating or not operating. Several limitations were encountered in attempting to correlate pumping activity with relatively short-term changes in contaminant concentrations at single sampling points. It must be considered that any analytical result represents the concentration at a discrete point at a discrete time. Monthly pumping volumes (Figure 3-19) do not reflect actual times and durations that the pumps were operating within that month, and therefore may or may not be indicative of pumping activity at a given time during that month. Further, the groundwater gradients shown in Figures 3-20 through 3-32 indicate only potential for flow, and may not reflect actual flow rates. Finally, various compounds adsorb to, and move through various aquifer materials differently. These and other unknowns make it exceedingly difficult to directly explain a specific constituent concentration at a particular sampling point. Therefore, in the following discussion the pumping volume data are used with reasonable confidence to support interpretations regarding large-scale contaminant migration, and are not used to explain relatively short-term changes in concentrations at individual sampling points.

4.2.1 Volatile Organic Compounds

Table 4-6 is a summary of all the VOCs detected during the RI in the JPL groundwater monitoring wells. As shown in Table 4-6, only three VOCs, CCl₄, TCE, and 1,2-DCA were found in on-site groundwater monitoring wells at levels exceeding CA MCLs. Of these, only CCl₄ and TCE were found in the off-site groundwater monitoring wells in excess of their MCLs. 1,2-DCA was not detected in any off-site wells. PCE was also detected in the study area, but at levels well below state and Federal MCLs. The remainder of this section focuses on four VOCs: CCl₄, TCE, 1,2-DCA, and PCE. Although not detected above its MCL, PCE is included in this discussion pursuant to regulatory agency requests.

The CCl₄, TCE, 1,2-DCA and PCE concentrations for sampling events conducted near the beginning of the RI (August/September, 1996), and at the end of the RI (January/February, 1998) were used to prepare contaminant contour maps in an effort to allow for visualization of the plumes over time. Although RI data have been collected since 1994, this approach was used

because the August/September, 1996 sampling event was the first event during which all wells (on-and offsite) were sampled concurrently. Therefore, this data set was the first that could be contoured and directly compared with the most recent data set. In addition, in order to evaluate temporal trends more completely, graphs showing concentrations of the above mentioned VOCs at each monitoring point since groundwater monitoring began at JPL in March, 1990 are also presented.

Separate maps were prepared for each constituent in each aquifer layer; and for cases where a constituent was not detected in a particular aquifer layer, a map was not prepared. For the multi-port wells, when more than one screened interval for a given well was present in a particular aquifer layer, the maximum concentration detected in that particular aquifer layer for the given well was used for the contaminant contour map. Because of limitations inherent in all groundwater investigations of this size, all plume boundaries can not be definitively known. It is therefore noted that on all contamination contour maps presented in this report, question marks were used to show where the extent of a plume is not well defined. By studying the shape and location of the plumes (for a given aquifer layer) over the specified time period, spatial trends, if any, were evaluated. As mentioned, variations in concentrations of the four VOCs over the entire RI at each monitoring point (for a given aquifer layer) were plotted on graphs and temporal trends in concentrations, if any, were evaluated.

Also, as discussed above, a number of production wells in the study area have reported detectable concentrations of the above-mentioned VOCs. For reasons already outlined, such data was generally not used to directly plot contaminant contours, but is included on the maps to serve primarily as a check on plume boundaries (see Section 4.1.3 for detailed discussion). Table 4-7 shows the elevations of the off-site production well pumps and perforations, and their locations within the defined aquifer layers. The pumps in the nearby production wells are located at depths corresponding with either Aquifer Layer 2 or Layer 3. Perforations in the production wells, however, encompass either Aquifer Layers 1, 2, and 3; Layers 2 and 3; or Layers 1 and 2, depending on the well, making precise use of the data from the production wells difficult.

Extensive VOC data has been collected during the RI period from the off-site JPL monitoring wells. These data suggest that no VOCs are present in Aquifer Layer 1 near the City of Pasadena and Lincoln Avenue Water Company production wells. For this reason, the assumption was made that the VOCs present in the City of Pasadena and the Lincoln Avenue Water Company production well samples result from the presence of the constituent VOCs in the lower aquifer layers (although as shown in Table 4-7, perforations for three of the City of Pasadena wells extend into Aquifer Layer 1). Therefore, chemical (VOC) data from the City of Pasadena and Lincoln Avenue Water Company production wells (shown graphically on Figure 4-2, and on Tables 4-2 and 4-3) are used mainly to corroborate plume extents in Aquifer Layers 2 and 3, only. Also, since RI data is not available from the immediate vicinity of the remaining off-site production wells, no aquifer layers were ruled out as potential sources of contaminants present in these production wells. Therefore, chemical data from all other production wells (La Canada

Irrigation District, Valley Water Company, Rubio Cañon Land and Water Company, and Las Flores Water Company) are included in the contaminant contour maps for all aquifer layers.

It is again noted that no VOCs or other constituents of interest have been detected in Aquifer Layer 4 (MW-20, Screen 5), and hence, no contour maps were generated for this layer.

Discussions of each of the individual VOCs mentioned above (CCl_4 , TCE, 1,2-DCA, and PCE) are included below.

4.2.1.1 Carbon Tetrachloride

Layer 1

Contaminant contour maps for CCl_4 in Layer 1 for the August/September 1996 and the January/February 1998 sampling events are shown in Figures 4-3 and 4-4, respectively. As is apparent from these figures, CCl_4 contamination in Layer 1 is primarily limited to the JPL site. The source of CCl_4 appears to be located at the north-central part of the site, with the plume in Layer 1 extending to the southern, central part of the site.

The Layer 1 CCl_4 plume appears limited in its southeasterly movement, although significant groundwater flow occurs in this direction. This is likely due to three main factors. First, the density of CCl_4 (1.59) is greater than that of water, which would cause it to migrate downward with time, into the lower aquifer layers. Secondly, as shown in Figures 3-21 and 3-22, groundwater flow at the north-central part of JPL is minimal in most cases, and subtle "ponding" can occur which would serve to inhibit off-site flow. Thirdly and probably most importantly, operation of the City of Pasadena municipal pumping wells, which are screened at depths corresponding to the lower aquifer layers, significantly lowers water pressures around the pumping wells creating an enhanced, downward vertical flow of groundwater into Layer 2. This likely explains why monitoring wells in Layer 1 immediately south and east of the Layer 1 CCl_4 plume contain no CCl_4 , and is the basis for the assumption that the CCl_4 detected in the City of Pasadena and Lincoln Avenue Water Company production wells is unassociated with Aquifer Layer 1.

A comparison of Figures 4-3 and 4-4 suggests that in general, there has been little or no expansion of the Layer 1 CCl_4 plume from August 1996 to January 1998. This is generally corroborated by data presented in Figure 4-5 (upper graph), which shows the variations of CCl_4 concentrations in monitoring wells located in the Layer 1 plume (as well as the other layers) throughout the RI period. As this figure shows, there is a gradual decrease in CCl_4 concentrations in wells MW-16 and MW-13 throughout the RI. For the well with the highest CCl_4 concentration (MW-7), there have been wide fluctuations in concentrations since 1990. Although concentrations in early 1997 appeared to drop considerably compared to the late 1996 concentrations, they increased again in late 1997 and early 1998 to levels comparable to those measured in 1996. Although less clear, overall trends still suggest that the CCl_4 concentration in MW-7 is not increasing, and may be slightly decreasing over time. Reasonably similar trends were displayed in MW-11, and for the remaining wells, concentrations have remained relatively constant.

Overall, this data suggests that: 1) the CCl_4 plume is fairly stable in Layer 1 in terms of area extent; 2) the concentrations in monitoring wells located in the plume are not increasing over time; and 3) that downgradient Layer 1 wells have not become contaminated, probably as a result of operation of the City of Pasadena municipal production wells "pulling" CCl_4 into the lower aquifer layers.

Layer 2

Contaminant contour maps showing CCl_4 plumes for Layer 2 for the August/September 1996 and the January/February 1998 sampling events are shown in Figures 4-6 and 4-7, respectively. As these figures show, CCl_4 contamination in Layer 2 extends off-site. The area extent of the plume in Layer 2 is significantly greater than that in Layer 1, although concentrations are much lower. However, the size and shape of the Layer 2 plume appears to have changed little over the time period represented by the two contaminant contour maps (August/September, 1996 to January/February, 1998).

The shape and distribution of the Layer 2 CCl_4 plume conforms to the known groundwater flow patterns, as influenced by the City of Pasadena municipal production wells. Figure 4-5 (middle graph) shows that for the Layer 2 plume wells, concentrations have generally been stable or decreased over the RI period, with the exception of on-site well MW-12 Screen 3 and off-site well MW-17 Screen 3, and possibly on-site well MW-4 Screen 2. MW-12 Screen 3 lies directly downgradient and beneath the Layer 1 CCl_4 plume, and may receive pulses of this constituent at various times in response to City of Pasadena pumping well activity. MW-17 Screen 3 is located downgradient (approximately 1,000 ft) from Pasadena City Well #52 and only a few hundred feet from the Lincoln Avenue Water Company Well #3 (see Figure 2-1). When Lincoln Avenue Water Company Well #3 is operating, it creates a cone of depression around itself, which impacts JPL MW-17, potentially increasing flow of groundwater (and hence CCl_4) toward MW-17 from the JPL site (see Figure 3-25). Conversely, when Lincoln Avenue Water Company Well #3 is not operating, but the City of Pasadena wells are operating, the flow direction is from MW-17 westward, toward the City of Pasadena wells and hence the JPL site (see Figure 3-26). In addition, MW-17 is located near to and downgradient from the Arroyo Seco spreading grounds, and the decrease in concentration noted for Screen 3 occurs just after a period of extensive groundwater recharge (see Figure 4-1). Given these influences, it is expected that some random fluctuations in CCl_4 concentrations over time in MW-17 will occur, and this is what is observed (Figure 4-5, middle graph). With regard to MW-4 Screen 2, periodic fluctuations in CCl_4 concentrations have been observed, also possibly due to the City of Pasadena Production wells. However, they were relatively small, and the concentration was only slightly above the detection limit in January, 1998. Finally, the CCl_4 concentration in MW-24 Screen 2 appears to have increased from September, 1997 to January, 1998. However, this is a new well which has only been sampled two times, and trends are not yet apparent.

The data obtained suggests that the Layer 2 CCl_4 plume: 1) is areally more extensive, but contains lower concentrations than the Layer 1 plume; 2) appears to be an extension of the Layer 1 plume in the downward and southeastern directions, consistent with pumping by the

nearby municipal production wells and groundwater flow patterns; and 3) based on the large area influenced by the City of Pasadena wells, the evidence suggests that the off-site plume will be inhibited from migrating significantly downgradient when the nearby production wells are pumping.

Layer 3

Contaminant contour maps for CCl_4 for Layer 3 for the August/September 1996 and the January/February 1998 sampling events are shown in Figures 4-8 and 4-9, respectively. As with the Layer 2 plume, CCl_4 contamination in Layer 3 extends off-site, although concentrations in the Layer 3 plume are generally much lower than those in the upper 2 layers. Concentrations of CCl_4 in the Layer 3 JPL plume wells (sampling points) have remained relatively constant over the period of August 1996 through January, 1998 (Figure 4-5, lower graph). The shape and extent of the plume in Layer 3 again suggest downward and some southeastern migration consistent with pumping of the municipal wells. The data indicate that pumping of the municipal production wells inhibits expansion of the Layer 3 CCl_4 plume further off-site.

The Layer 3 plume maps indicate a reduction in the size of the plume over time (Figures 4-8 and 4-9), but this may be somewhat misleading. Contours in these figures encompass various City of Pasadena production wells and both Lincoln Avenue Water Company production wells, since, as discussed above, the aquifer layer from which the CCl_4 originates in the production wells is unclear. Data from JPL monitoring wells suggest, however, that the CCl_4 detected in several of the production wells most likely originated from Aquifer Layer 2 and therefore, inclusion of these wells within the boundaries of the Layer 3 plume may not be warranted. For this reason, the Layer 3 plume shown for August/September, 1996 probably represents an exaggeration and therefore a worst-case scenario.

The rationale for these assertions is as follows (refer to Figures 4-8, 4-9 and Table 4-5). Carbon tetrachloride has never been detected in MW-17 Screens 4 and 5 (Layer 3 screens), but has consistently been detected in MW-17 Screen 3 (Layer 2). This suggests that the CCl_4 detected in the Lincoln Avenue wells originated in Layer 2. In addition, CCl_4 has never been detected in the City of Pasadena Ventura Well (eleven analyses have been conducted since 1994) or the Windsor Well (thirty-four analyses have been conducted since 1994). The entire southern arm of the Layer 3 CCl_4 plume for the August/September 1996 event (Figure 4-8) is based on a concentration of $0.5 \mu\text{g/L}$ detected in MW-19 Screen 4 for that event ($0.5 \mu\text{g/L}$ is the detection limit). Carbon tetrachloride has never been subsequently detected in MW-19 Screen 4 (it was detected once prior, in the July/August 1995 event, at a concentration of $0.6 \mu\text{g/L}$), and has never been detected in MW-19 Screen 5. The reason for the presence of CCl_4 in MW-19 Screen 4 early in the sampling program (August/September 1996) is unclear, but overall, the data suggest that CCl_4 is typically not present at detectable levels in the vicinity of MW-19 and the southernmost City of Pasadena wells. Detection of CCl_4 in MW-19 Screen 4 in August/September 1996 seems anomalous, possibly due to a pulse drawn down during a temporary period of extended pumping of the Windsor and/or Ventura Wells.

Regarding the Layer 3 CCl₄ plume, it appears that: 1) the plume is probably not as extensive as depicted in Figures 4-8 and 4-9, due to inclusion of results from several production wells which may have originated from Layer 2; 2) the plume is not increasing in size; 3) concentrations in plume wells are relatively constant; and 4) movement/containment of the plume is most likely influenced by the municipal pumping wells.

4.2.1.2 Trichloroethene

Layer 1

Contaminant contour maps for TCE in Layer 1 for the August/September 1996 and the January/February 1998 sampling events are shown in Figures 4-10 and 4-11, respectively. Data presented in these figures suggest that there are at least two sources for Layer 1 TCE, one originating in the north-central area of JPL, and another emanating upgradient of JPL, from a currently unknown source or sources (based primarily on the presence of TCE in the upgradient Valley Water Company wells). Potential sources are discussed further in Section 4.3. Based on general groundwater flow patterns and concentrations measured in MW-10, the on-site and off-site TCE appear to merge somewhere between the southern portion of JPL and MW-21.

The location and shape of the on-site portion of the TCE plume are similar to those of the CCl₄ plume for Layer 1. Comparison of the Layer 1 TCE plume maps for the two periods represented suggests that the plume is generally stable in size over time. This is generally supported by data presented in Figure 4-12 (upper graph), which shows chronological concentrations of TCE in Layer 1 plume wells (as well as in all plume wells in each layer) since 1990. As is suggested from this figure, even though wide fluctuations have been observed in MW-7, concentrations in Layer 1 plume wells generally remain constant, or decrease over time, especially over the last 5 years (1994-1998). It is noted that MW-24 Screen 1 appears to be an exception, however as this well is a recent addition to the program, it has only been sampled during the last two events, and thus a meaningful trend can not yet be established.

To summarize, the data suggests that: 1) there appears to be at least two sources of TCE forming an off-site plume and an on-site plume, which merge near or below the southern portion of JPL; 2) TCE concentrations in Layer 1 plume wells are generally stable or decrease with time; and 3) TCE contamination downgradient of the Layer 1 wells is inhibited due to the enhanced downward flow induced by pumping of the City of Pasadena production wells.

Layer 2

Contaminant contour maps for TCE in Layer 2 for the two sampling events represented are presented in Figures 4-13 and 4-14. It is apparent from the data presented in these figures that the off-site and on-site Layer 1 TCE have merged following horizontal and vertical groundwater flow patterns to form a larger plume in Layer 2 with lower concentrations. This plume encompasses the south-central portion of JPL, and extends off-site in the southern and eastern directions. Trichloroethene has also been detected in downgradient City of Pasadena and Lincoln Avenue Water Company production wells. The shape and migration pattern of the Layer 2 TCE

plume is similar to that of the Layer 2 CCl_4 plume, however, the TCE plume extends further south, possibly due to the apparent upgradient off-site source or sources (see Section 4.3).

The Layer 2 contaminant contour maps (Figure 4-13 and 4-14) suggest that the plume is generally stable in size with time. This is supported by data presented in Figure 4-12 (middle graph), which, with two exceptions, generally reflects constant TCE levels in Layer 2 plume wells over the RI time period. As observed with CCl_4 , large fluctuations in TCE levels were observed in MW-17 Screen 3 and MW-4 Screen 2, probably due to their proximity to production wells and the spreading grounds as described above (see discussion in Section 4.1.2.1).

Regarding the Layer 2 TCE plume: 1) the plume appears to be an extension and a confluence of the on-site and off-site TCE identified in Layer 1; 2) it is similar to the Layer 2 CCl_4 plume, but extends further south, possibly due to an apparent off-site source(s); 3) the data suggest that the plume is relatively stable in size, possibly due to pumping by the City of Pasadena production wells; and 4) concentrations in the plume wells are relatively constant or slightly decreasing with time.

Layer 3

Contaminant contour maps for TCE in Layer 3 for the two representative sampling events are shown on Figures 4-15 and 4-16. The figures show that the majority of TCE contamination in Layer 3 is off-site. This plume appears to be somewhat more extensive than the Layer 3 CCl_4 plume, definitely extending through MW-17, and therefore possibly accounting for some of the TCE detected in the Lincoln Avenue Water Company production wells. The data suggest that the plume is generally stable in size. As shown in Figure 4-12 (lower graph), TCE concentrations in Layer 3 plume wells are remaining relatively constant or slightly decreasing, and are currently below or near the CA MCL.

4.2.1.3 1,2-Dichloroethane

Layer 1

Figures 4-17 and 4-18 show the contaminant contour maps of the 1,2-DCA plume in Layer 1 for the two represented sampling events. As the figures show, 1,2-DCA contamination in Layer 1 is limited to on-site. There has been little change in the shape of the plume over the time period depicted, where concentrations have generally remained constant. Figure 4-19 shows the 1,2-DCA concentration in the four wells located within the Layer 1 plume over time. It is evident from this figure that while concentrations in MW-13 and MW-16 were elevated in 1990, these levels have decreased rapidly, and all 1,2-DCA concentrations are currently below or near the CA MCL of 0.5 $\mu\text{g/L}$.

The location of the plume in Layer 1 is similar to those of the CCl_4 and the TCE (on-site) plumes in Layer 1, and for reasons described in Section 4.2.1.1, it is unlikely that the Layer 1 1,2-DCA plume will migrate further to any extent in Layer 1. 1,2-DCA was not commonly used in industrial applications, however, it is one of several potential metabolites of (and may provide evidence for) bacterial reductive dechlorination of TCE. This may explain its presence in the JPL groundwater.

Layer 2

Figure 4-20 shows the extent of 1,2-DCA contamination for the August/September, 1996 event in Layer 2 (the compound was only detected in one well, MW-4 Screen 2). 1,2-DCA was not detected in Layer 2 well screens over the final three RI sampling events, and therefore, only one contaminant contour map for Layer 2 is presented. The location of the 1,2-DCA "plume" is consistent with groundwater flow patterns and plume transitions between Aquifer Layers 1 and 2 observed for CCl₄ and TCE as described above. Figure 4-19 shows that the concentration of 1,2-DCA in Layer 2 (MW-4 Screen 2) has decreased to below detection limits with time.

Layer 3

1,2-DCA was not detected in any Layer 3 well screens during the RI period.

4.2.1.4 Tetrachloroethene (PCE)

Layer 1

Contaminant contour maps for PCE detected in Layer 1 for the two representative sampling events are presented in Figures 4-21 and 4-22. The data indicate that PCE is present on-site in the area located near the north-central portion of the site, and off-site, particularly in the upgradient Valley Water Company municipal wells extending to and below the southern portion of the site.

The location and extent of the Layer 1 PCE have exhibited little change over the RI time period. Figure 4-23 (upper graph) shows the PCE concentrations in Layer 1 wells over time for the RI period. The concentrations initially approached 28 µg/L in MW-7, but decreased over the next two years, and PCE concentrations in all JPL wells are now well below the CA MCL for PCE (5.0 µg/L) and have been since April, 1992. It appears evident from Figures 4-21 and 4-22 that PCE is present in both on-site and off-site wells. When the August/September 1996 event was conducted, MW-23 had not been installed. In light of PCE being detected in MW-23 Screen 1 following its installation in September, 1997, and that concentrations in Layer 1 wells have remained relatively constant (Figure 4-23, upper graph), it is likely that the extent of PCE shown in Figure 4-22 represents the extent of PCE contamination in Layer 1 at both sampling times.

The data suggests that Layer 1 PCE: 1) can be traced continuously between on-site and off-site wells; 2) is relatively stable, apparently not increasing in extent; and 3) was not detected above its MCL at JPL, during the RI (1994-1998).

Layer 2

Contaminant contour maps depicting the extent of PCE in Layer 2 for the two representative sampling events are given in Figures 4-24 and 4-25. Information in these figures reveals that PCE in Layer 2 is mostly off-site. The shape and location of the Layer 2 plume are consistent with downward and southeasterly expansion of the PCE detected in Layer 1. The plume size and shape has remained constant over the time elapsed between the sampling events depicted in Figures 4-24 and 4-25, and without exception, is present in JPL monitoring wells below its MCL. This is in agreement with data presented in Figure 4-23 (middle graph), which shows PCE

concentrations over the entire RI period. As depicted, PCE levels in JPL wells have remained relatively constant, and have not exceeded the MCL.

Layer 3

Figures 4-26 and 4-27 contain contaminant contour maps for PCE detected in Layer 3 for the two representative sampling events represented. Data presented here show that PCE in Layer 3 is completely off-site. The shape and location of this plume is similar to those of the Layer 3 TCE plume. The Layer 3 PCE plume is also markedly similar to the PCE plume in Layer 2, suggesting a downward migration of the Layer 2 plume. Figures 4-26 and 4-27 show that the shape and location of the Layer 3 plume have not changed appreciably over the time period assessed. This assertion is supported in Figure 4-23, (lower graph) which shows PCE levels in Layer 3 plume wells over time. As shown in Figure 4-23, Layer 3 PCE concentrations in JPL wells are reasonably constant over time, and without exception, below its MCL.

4.2.1.5 Other Volatile Organic Compounds

Total trihalomethanes (mainly chloroform) were detected one or more times during the RI in all JPL monitoring wells except MW-9, MW-15 and MW-22. Concentrations of trihalomethanes were always well below the Federal MCL of 100 µg/L. A state MCL for total trihalomethanes has not yet been established. The highest levels detected during the RI were found in MW-16.

Several other VOCs were sporadically detected, including acetone, dichloromethane, Freon 113, carbon disulfide, acetic acid, 1,1,2,2-tetrachloroethane, 1,1-DCA, 1,1-DCE, various benzene derivatives, and a few unidentifiable compounds, mostly at levels <5 µg/L (see Table 4-6 for a complete list). Most of these compounds are common laboratory contaminants, or were rarely or sporadically detected. None were present in concentrations exceeding MCLs, where MCLs were established.

4.2.1.6 VOCs in Perched Groundwater

In March and April 1998, eight multi-port soil-vapor monitoring wells were installed on-site as part of the OU-2 RI (on-site contaminant source investigation) to further delineate a VOC vapor plume detected in the vadose zone (Foster Wheeler, 1998c,d). All wells were scheduled to be drilled to just above the groundwater table and contain multiple soil-vapor probes. During the drilling of two of the borings, B-34 and B-36, water was encountered shallower than was estimated from surrounding groundwater monitoring wells. Water was not, however, encountered shallower than expected in the other six soil borings installed at that time. Water was encountered in boring B-34 approximately 40 feet above what was estimated, and water was encountered in boring B-36 approximately 120 feet above what was estimated. Perched groundwater was not expected to be encountered during drilling and was apparently present in these two areas due to the excessive precipitation received during the year with the El Niño weather patterns.

Samples of the water encountered in each boring were collected using a bailer before each boring was backfilled to above the water and the multi-port soil-vapor monitoring wells installed.

Montgomery Watson Laboratories analyzed the samples for VOCs (EPA Method 524.2) and perchlorate (EPA Method 300). Figure 4-28 shows the locations of borings B-34 and B-36, the locations of the other soil borings drilled at that time, and the water table configuration present at that time. The water encountered in B-34 contained 1.1 µg/L PCE, 1.7 µg/L Freon 113, 1.8 µg/L, 1,1-DCE, 4.7 µg/L TCE, 19.7 µg/L total trihalomethanes, 92 µg/L CCl₄ and 200 µg/L perchlorate. The water encountered in B-36 contained 0.8 µg/L 1,1-DCA, 1.3 µg/L PCE, 3.5 µg/L Freon 113, 8.8 µg/L 1,1-DCE, 23 µg/L CCl₄, 43 µg/L TCE, and 1,170 µg/L perchlorate.

The types and levels of VOCs and perchlorate detected in borings B-34 and B-36 are similar to those encountered at the groundwater table in nearby groundwater monitoring wells (see Section 4.2.2 for further discussion on perchlorate). Relatively higher levels of VOCs and perchlorate were detected in B-36 located near monitoring well MW-16 in the north-central portion of JPL, where higher levels of VOCs and perchlorate have consistently been detected in the groundwater. Relatively lower levels of VOCs and perchlorate were detected in B-34, located between monitoring wells MW-24 and MW-8, where lower levels of VOCs and perchlorate have consistently been detected. The relative similarity of the analytical results from the shallow groundwater encountered in B-34 and B-36 and nearby groundwater monitoring wells supports the conclusions presented in this section regarding the extent of groundwater contamination.

4.2.2 Perchlorate

Perchlorate (ClO₄⁻), which is a non-volatile oxyanion of chlorine (Cl), has recently been detected in JPL groundwater monitoring wells at levels above the CA DHS Interim Action Level (IAL) of 18 µg/L (no state or Federal MCLs for ClO₄⁻ currently exist). Analyses for ClO₄⁻ in JPL groundwater were performed during the June/July 1997, September/October 1997, and January/February 1998 sampling events following a request from the CA DHS. The current analytical technique, with detection (reporting) limit of 4 µg/L has only been available within the last year, and is still being refined (Howard Okomoto, CA DHS, in paper presented at the Perchlorate Stakeholders Forum, Henderson Nevada, May 19-21, 1998). Previously used techniques could not quantify ClO₄⁻ concentrations in groundwater below 100 µg/L. Results of these analyses are included in Table 4-6. Perchlorate has also been detected in upgradient and downgradient municipal production wells. Because ClO₄⁻ analysis was conducted only during the last three RI events, only one ClO₄⁻ contaminant contour map was prepared for each aquifer layer representing the most recent analytical results (January/February 1998). In addition, ClO₄⁻ data from municipal production wells are included in the ClO₄⁻ contour maps and used in the same manner as described for VOCs (see Section 4.2.1).

Layer 1

The contaminant contour map for ClO₄⁻ in Layer 1 for the January/February 1998 sampling event is presented in Figure 4-29. As shown here, the portion of the Layer 1 plume exceeding the IAL of 18 µg/L is located on-site. The shape of the on-site ClO₄⁻ appears similar to on-site CCl₄ and TCE Layer 1 plumes, suggesting a ClO₄⁻ source in the vicinity of the north-central part of JPL, and also suggesting that the response of ClO₄⁻ to local municipal well pumping is similar to that of the VOCs.

Data presented in Figure 4-29 suggest there is more than one source for ClO_4^- . In addition to an on-site source, the presence of ClO_4^- in the upgradient Valley Water Company production wells suggest the presence of an upgradient source. The rationale for potential upgradient ClO_4^- sources is discussed further in Section 4.3. Based on general groundwater flow patterns and the concentration measured in MW-10, the on-site and off-site ClO_4^- appear to merge somewhere between the southern portion of JPL and MW-21.

ClO_4^- has been detected in the two northernmost City of Pasadena production wells and both Lincoln Avenue Water Company wells. However, because the shape of the on-site plume is similar to the on-site CCl_4 and TCE plumes, it is assumed it is similarly affected by off-site pumping, and the ClO_4^- detected in the City of Pasadena and Lincoln Avenue Water Company production wells is likely associated with Aquifer Layer 2, not Aquifer Layer 1, and therefore chemical data from these production wells has been omitted from the Layer 1 contaminant contour map.

The detection of ClO_4^- in Layer 1 in MW-20, and in the Rubio Cañon and Las Flores production wells, shows that some ClO_4^- is located beyond the apparent plume boundary in Layer 1 (Figure 4-29). As noted, ClO_4^- has not been detected in Layer 1 in JPL monitoring wells MW-17 and MW-19, which are both upgradient of MW-20. However, ClO_4^- has been detected in well MW-17 deeper in the aquifer (Aquifer Layers 2 and 3), which, similar to the VOCs, is a result of the enhanced downward flow induced by nearby municipal well pumping. The fact that ClO_4^- is in Aquifer Layer 1 in MW-20, located downgradient of well MW-17, where perchlorate is in Aquifer Layer 2 and 3, is inconsistent with groundwater flow patterns around the JPL site. The groundwater type associated with MW-20 Screen 1 is associated with the off-site water type (Type 3, Section 3.4.2). It is, therefore, possible that the ClO_4^- present in MW-20 Screen 1 may reflect a pulse, which is consistent with irregular injections from the potential off-site source (for further discussions on potential ClO_4^- sources, see Section 4.3). The concentration of ClO_4^- in MW-20 Screen 1, however, is near the detection (reporting) limit, and in light of spatial, analytical and statistical variability, any such explanation is largely speculative. Given current analytical capabilities, the source of ClO_4^- in MW-20 Screen 1 would be difficult to substantiate, but it does not appear necessary at this time, as these concentrations are well below the CA IAL.

In summary, the data suggests that: 1) as with TCE, there appears to be more than one source of ClO_4^- , which seem to merge near or below the southern portion of JPL; and 2) the portion of the Layer 1 ClO_4^- plume which exceeds the CA IAL is localized on-site.

Layer 2

The contaminant contour map showing the extent of ClO_4^- in Layer 2 for the January/February 1998 sampling event is shown in Figure 4-30. As shown in Figure 4-30, the Layer 2 plume appears to be an extension of the Layer 1 ClO_4^- in the downward and southeastern directions, as is consistent with general groundwater flow patterns and pumping of the nearby production wells. The portion of the plume with concentrations exceeding the CA IAL is located in the north-central portion of JPL and extends into the vicinity of the northernmost City of Pasadena

production well (Arroyo Well). ClO_4^- was also detected at concentrations well below the CA IAL in wells located downgradient from the City of Pasadena production wells, including the Rubio Cañon Land and Water Company Wells, and the Las Flores Water Company Well.

Regarding the Layer 2 ClO_4^- plume: 1) the plume appears to be a convergence of the apparent plumes identified in Layer 1, extending downward in response to pumping by the City of Pasadena and other production wells; 2) the portion of the plume which exceeds the CA IAL extends from on-site to the northernmost City of Pasadena wells; and 3) significant levels of ClO_4^- appear to have been inhibited from further downgradient migration by the City of Pasadena and other production wells.

Layer 3

The contaminant contour map for ClO_4^- in Layer 3 for the January/February 1998 sampling event is given in Figure 4-31. Comparison of Figure 4-31 with 4-29 shows that the Layer 3 ClO_4^- plume is smaller in size than the Layer 2 ClO_4^- plume, with the concentrations of ClO_4^- being lower in the Layer 3 plume.

Regarding the Layer 3 ClO_4^- plume: 1) the plume appears to be an extension of the Layer 2 plume in the downward direction as influenced by City of Pasadena and other production wells; and 2) the concentrations of ClO_4^- are lower than the Layer 2 plume.

4.2.3 Semi-Volatile Organic Compounds

Analyses of SVOCs were carried out during the June/July, 1994 and the November/December, 1994 sampling events for the OU-1 on-site wells, and the July/August, 1995 and December/January, 1995-96 sampling events for the OU-3 off-site wells. Results are summarized in Table 4-8 (all detected compounds are reported). SVOCs were not detected above applicable MCLs in any wells, with the exception of one sample from MW-12 Screen 2, in which some polycyclic aromatic hydrocarbons (PAHs) were detected above their MCLs (Table 4-8) during the June/July 1994 event. The only SVOCs detected during the RI with any frequency were di(2-ethylhexyl)phthalate (at 0.5 to 4.2 $\mu\text{g/L}$ in 13 of 129 samples), di-n-butylphthate (at 10 to 16 $\mu\text{g/L}$ in 8 of 129 samples), and ethylbenzene (at 8.3 to 30.0 $\mu\text{g/L}$ in 34 of 129 samples). Ethylbenzene is considered a VOC, but it was tentatively identified in the SVOCs analysis, and is therefore considered here. Di(2-ethylhexyl)phthalate and di-n-butylphthate are common laboratory contaminants and were also detected in several laboratory blanks. For all except one positive ethylbenzene result, or 97 percent of the analyses, the associated laboratory method blank was also positive for ethylbenzene, indicating laboratory contamination. With the approval of the regulators, no further analyses were conducted for SVOCs after the December/January, 1995-96 with the exception of MW-12 Screen 2.

With regard to the PAHs detected in MW-12 Screen 2 in June/July, 1994, a duplicate sample from MW-12 Screen 2 was also collected and analyzed during the June/July 1994 event, and no PAHs were detected. In addition, no PAHs were detected in MW-12 Screen 2 during the subsequent November/December, 1994 event. Thus, evidence suggested that the initial detects

were anomalous, but they could not be explained. To further investigate, an additional sample and duplicate sample from MW-12 Screen 2 was analyzed for SVOCs (only the PAHs that had been previously detected) during the August/September, 1996 event, and again, no PAHs were detected. It was therefore concluded that the initial detects were anomalous and with the approval of the regulating agencies, SVOCs were excluded from the sampling program for subsequent events.

4.2.4 Metals and Cyanide

During the first two RI sampling events for OU-1 (June/July, 1994 and November/December, 1994) and OU-3 (July/August, 1995 and December/January, 1995-96) groundwater samples were analyzed for Title 26 metals (see Table 4-2 for list of Title 26 metals) plus strontium (Sr), and cyanide (CN) as shown in Table 4-1. Aluminum (Al) analysis was also carried out during the second of the first two events for OU-1, during both of the first two OU-3 events, and during the first JPL long-term quarterly sampling event to screen for its presence in JPL groundwater (August/September, 1996) (see Table 4-1). Based on the results of these analyses and risk assessment screening (Foster Wheeler, 1996h), all metals (and CN) were eliminated from further analysis, with regulatory agency approval, except arsenic (As), lead (Pb), and chromium (Cr) (analyses for both total and hexavalent Cr [Cr(VI)] were retained). The majority of metals were eliminated from the sampling program because they were either not detected or were present at such low levels, well below regulatory limits, that they were not considered a concern. Thus As, Pb and Cr (total and hexavalent) were the only metals (excluding major cations) included in the long-term quarterly groundwater monitoring program (Al was included in the first long-term quarterly event only for screening purposes). Metals results are discussed below.

4.2.4.1 Title 26 Metals, Aluminum, Strontium and Cyanide

As summarized above in Section 4.2.4, samples from the first several RI groundwater sampling events were analyzed for Title 26 metals, Sr, Al and CN. Results of these analyses are summarized in Table 4-9.

During the early RI events, metals analyses were conducted on both filtered (0.45 μ m pore filter size) and un-filtered samples in an effort to discern between suspended and dissolved fractions (Table 4-1). The filtrations were carried out in the field by sampling personnel. Analytical results from filtered and non-filtered samples were within reasonable agreement, and therefore, filtering samples in the field prior to shipment and analysis was discontinued.

As shown in Table 4-9, several metals, as well as CN, were detected in groundwater samples from JPL monitoring wells. Metals detected included: Al, As, barium (Ba), Cr [total Cr and Cr(VI)], copper (Cu), nickel (Ni), Pb, Sr, and zinc (Zn). Most of these were detected at very low levels, well below regulatory limits. Maximum detected levels of metals and CN were compared to conservative health risk screened criteria (EPA Preliminary Remediation Goals and state Preliminary Endangerment Assessment guidelines) to evaluate which metals should continue to be monitored during the long-term quarterly monitoring program, which began in August 1996.

Results of this screening are included on Table 4-10. Based on this conservative risk screening, and subsequent approval from EPA, DTSC, and RWQCB regulators, CN, Al, Sr, and all Title 26 metals except As, Cr [total and Cr(VI)], and Pb were eliminated from further analyses in subsequent groundwater sampling events. Results of analyses for the remaining metals in subsequent events are discussed below in Sections 4.2.4.2 through 4.2.4.5.

4.2.4.2 Chromium and Hexavalent Chromium

Groundwater samples from JPL wells were analyzed for chromium during all six long-term quarterly monitoring events (August 1996 through January, 1998) as well as the first two OU-1 RI events (June/July and November/December, 1994) and the first two OU-3 RI events (July/August 1995 and December/January, 1995-96). Results are summarized in Table 4-11.

OU-1 Wells

Total Cr was detected in MW-4 Screen 2, MW-6, MW-7, MW-10, and MW-13, mostly at levels below MCLs, with the exception of one sample from MW-6 and one sample from MW-13 at the state MCL of 0.05 mg/L. Results of the last RI round of sampling indicated that only wells MW-7 and MW-13 had detectable concentrations, while for the remaining three wells (MW-4 Screen 2, MW-6, and MW-10) total Cr was below Practical Quantitation Limits. Chromium occurs naturally in various geologic materials, and consequently low levels in groundwater are not uncommon, depending on soil Cr levels in the surrounding watershed. Typical background Cr concentrations in California soils range as high as 99 mg/kg (Bradford, et al., 1996), and lower levels (up to 12.4 mg/kg) of Cr have been detected in JPL background soil samples, as well as virtually all JPL soil samples analyzed for the OU-2 RI.

Hexavalent Cr [Cr(VI)] was detected frequently in MW-7 and MW-13, and during one event, at very low levels, in three other wells. State and Federal MCLs for Cr(VI) have not yet been established. Concentrations of Cr(VI) have remained constant in MW-7 and MW-13, and its absence in nearby, downgradient wells suggest minimal migration. It is worth noting that under anaerobic conditions, Cr(VI) is subject to bioreduction reactions that in this case, may be a mechanism of attenuation. However, further work would be needed to confirm that these reactions are occurring in the JPL aquifer.

OU-3 Wells

Total Cr was detected only once in one off-site well, MW-18 Screen 3, in February/March 1997 at a concentration of 0.015 mg/L, which is well below its state and Federal MCLs. Cr(VI) has been detected two times off-site, once in MW-17 Screen 3, September/October 1997 (0.006 mg/L), and once in MW-18 Screen 3, in February/March 1997 (0.007 mg/L). Numerous non-detects in monitoring wells between on-site wells MW-7 and MW-13, and off-site wells MW-17 and MW-18 suggest there is no strong direct connection between the on- and off-site Cr and that no extensive Cr plume exists.

4.2.4.3 Lead

Results of lead (Pb) analysis performed on samples from on- and off-site wells during the RI are summarized in Table 4-11. Lead was detected sporadically and infrequently at levels well below the state and Federal action level. Lead is a common natural constituent of soils and has been detected in California soils at concentrations ranging as high as 97 mg/kg (Bradford, et al., 1996) and in JPL background soil samples collected during the OU-2 RI at levels up to 6.2 mg/kg (Table 2-16). The data suggest that with the random, scattered locations of detects, the very low frequency of detections, the low concentrations detected, and the natural occurrence of lead in JPL soils, that the Pb detected in the JPL groundwater is naturally occurring. The data do not suggest there is a Pb plume at JPL.

4.2.4.4 Arsenic

Results of arsenic (As) analysis performed on samples from on- and off-site wells for the RI events are summarized in Table 4-11. During the RI program, on- and off-site groundwater were analyzed for arsenic over 500 times, and As was detected only 12 times at very low levels, well below state and Federal MCLs. When detected, As was detected in the lower screens of the multi-port wells. Arsenic was detected at very low levels in 7 of 8 samples from MW-3 Screen 5, in 2 of 8 samples from MW-11 Screen 5, in 1 of 8 samples from MW-18 Screen 4, in 1 of 8 samples from MW-20 Screen 5, and in 1 of 2 samples from MW-24 Screen 3. Arsenic was only consistently detected in the deepest screen of MW-3. There is no correlation between the As in these wells, and no evidence an As plume. Arsenic is another common constituent of soil and has been found to occur naturally in California soils at concentrations ranging as high as 11 mg/kg (Bradford, et al., 1996). Background As soil levels measured at JPL during the OU-2 RI ranged up to 2.8 mg/kg. Similar to lead, the general low frequency of detections, the low concentrations detected, and the natural occurrence of As in JPL soils suggest the As detected in the groundwater is naturally occurring.

4.2.5 Tributyltin

Analyses for tributyltin (TBT) were performed on samples from select wells during five RI sampling events (Table 4-1) at the request of the DTSC. TBT has historically been used by industry in cooling towers as an anti-bacterial agent. Since cooling towers have, and still are, being used at JPL, TBT analyses were performed. The wells to be sampled and the number of samples to be collected were recommended and agreed upon by the regulatory agencies (EPA, DTSC, and RWQCB) prior to sampling. Wells sampled included MW-4 Screens 1 and 2, MW-8, MW-12 Screens 1 and 2, and MW-13 (Table 4-1).

There are currently no state or Federal MCLs for TBT. Therefore, the only applicable regulatory level is the EPA preliminary remediation goal (PRG) for TBT-oxide in water, of 1.1 µg/L (EPA, 1996a). PRGs are chemical concentrations published by the EPA used to estimate levels in environmental media that are protective of humans, including sensitive groups, over a lifetime. TBT was detected in one sample from MW-4 Screen 2 during the June/July, 1997 event, and in MW-12 Screen 1 during the August/September, 1996 and June/July, 1997 events at very low

levels (not greater than 0.005 µg/L). These results are three orders of magnitude lower than the EPA PRG of 1.1 µg/L. Analysis for TBT was subsequently discontinued after the September/October, 1997 event, pursuant to approval from the EPA, DTSC, and the RWQCB.

4.2.6 Total Petroleum Hydrocarbons

In 1991, during excavation activities for the foundation of JPL Building 306, a layer of soil was encountered that appeared to be impacted with petroleum hydrocarbons. Soil samples were collected and indicated the presence of TPH up to 5,500 mg/kg at an average depth of 5 feet below ground surface. Approximately 19,000 tons of soil were subsequently excavated and properly disposed off-site. For details of the investigation and excavation see Section 5.1.13 in the RI/FS Work Plan (Ebasco, 1993a).

To evaluate whether TPH was detectable in the groundwater, groundwater samples from all five screens from multi-port monitoring well MW-4, located immediately downgradient from Building 306, were analyzed for TPH during the first two RI sampling events (June 1994 and November 1994). TPH was not detected in well MW-4 during either sampling event. It was subsequently dropped as a constituent of concern pursuant to regulatory agency approval.

4.2.7 Gross Alpha/Gross Beta

During the initial information gathering phase for the OU-2 contaminant source RI, it was learned that JPL Building 67, although primarily an office building, at times in its history contained small laboratories and research rooms. Research involving kinetics, magnetics, computer development, spectroscopy, biology and low-level radioactivity were reportedly completed (Ebasco, 1993a). Based on this information, it was decided that low-level radioactivity would be evaluated in the vicinity of Building 67.

To evaluate whether above normal levels of radioactivity were in the groundwater, groundwater and duplicate groundwater samples from JPL monitoring well MW-13, located near Building 67, were analyzed for gross alpha and gross beta during the first two RI sampling events (June/July 1994 and November/December 1994). Results for gross alpha from the June/July 1994 and November/December 1994 events for the original/duplicate samples were 7.0/2.0 picocuries/liter (pCi/L) and 3.3/11.8 pCi/L, respectively. Results for gross beta from the June/July 1994 and the November/December 1994 events for the original/duplicate samples were 3.0/6.0 pCi/L and 3.9/4.7 pCi/L, respectively. All results were below MCLs established for gross alpha (15 pCi/L) and gross beta (50 pCi/L).

During the pre-RI groundwater sampling program completed at JPL between 1990 and 1993 (see Section 1.3.3.15), gross alpha and gross beta were analyzed in samples from all monitoring wells present at the time (MW-1 through MW-7) during Sampling Event No. 4 completed in June 1991. Results from all wells, including upgradient wells MW-1 and MW-6, for both gross alpha and gross beta were also below established MCLs (see Table 1-17). Results from JPL upgradient wells MW-1 and MW-6 for gross alpha were <11.1 pCi/L and <10.2 pCi/L, respectively, and for

gross beta were 8.6 ± 5.2 pCi/L and <7.1 pCi/L, respectively. As indicated, gross alpha and gross beta results obtained from well MW-13 during the RI are comparable to gross alpha and gross beta results obtained previously from upgradient sampling points.

4.2.8 Fluoride

During groundwater sampling of City of Pasadena's monitoring well MW-01 in 1984 by R.C. Slade, fluoride was reported in two of nine groundwater samples at levels above state and Federal MCLs (see Section 1.3.3.6). Fluoride was analyzed as part of a suite of major ions to characterize general water chemistry in JPL monitoring wells during 10 groundwater sampling events completed prior to the RI (1990 to 1993) (Section 1.3.3.15), during the first two OU-1 RI sampling events (June/July 1994 and November/December 1994), and during the first two OU-3 RI events (July/August 1995 and December/January 1995/1996). Results of JPL sampling for fluoride in on-site and off-site monitoring wells are summarized on Tables 4-12 and 4-13, respectively. Results of fluoride sampling in nearby municipal production wells are summarized on Table 4-4.

As summarized in Tables 4-4, 4-12 and 4-13, fluoride was not detected above the Federal MCL (4.0 mg/L) in any JPL well or municipal production well, but was detected slightly above the state MCL (1.4 to 2.4 mg/L, depending on temperature) consistently in the bottom screen (Screen 5) in multi-port well MW-3. Fluoride was detected consistently throughout the rest of the study area in very low levels below state and Federal MCLs. Fluoride occurs naturally in groundwater as the result of weathering of such minerals as fluorite, apatite and hornblende commonly found in a wide variety of geologic terrains (Hem, 1985). The widespread occurrence of low levels of fluoride throughout the study area suggest its presence is due to natural weathering processes. Fluoride detected in on-site wells is similar to, or typically lower, than that detected in JPL upgradient monitoring well MW-1 (Table 4-11). The lack of a fluoride "plume" in the study area also suggests the somewhat elevated levels detected in MW-3 Screen 5 is the result of natural conditions. Concentration as high as 50 mg/L of fluoride have been reported in natural water (Hem, 1985). It is interesting to note that the location where slightly elevated concentrations of fluoride were consistently detected (MW-3 Screen 5) is also the location where arsenic has consistently been detected. Based on the fluoride data, analyses for fluoride were discontinued after the December/January 1995/1996 event after approval from EPA, DTSC and the RWQCB.

4.3 SUMMARY OF SOURCES OF GROUNDWATER CONTAMINATION

This section contains a summary of the sources and potential sources of contaminants detected in the JPL groundwater as suggested or confirmed by data generated during the JPL groundwater (OU-1/OU-3) and soils (OU-2) RIs.

4.3.1 Potential On-Site Contaminant Sources

As discussed in Section 1.3, seepage pits were used during the 1940s and 1950s to dispose of liquid wastes collected from drains and sinks within various buildings at JPL. These seepage pits were designed to allow liquid wastes to seep into the surrounding soil. Preliminary investigations at JPL suggested that some of the seepage pits may have received various compounds associated with early research and development activities, including volatile organic compounds (VOCs) and other waste materials that are currently found in the groundwater. In the 1950s, a sanitary sewer system was installed and the use of seepage pits for liquid waste disposal was discontinued. During the OU-2 RI, soil borings were drilled in the areas where these seepage pits had been maintained, and soil and soil vapor samples from these borings were analyzed for a variety of organic and inorganic compounds and elements. Important results from the OU-2 RI are summarized below.

The OU-2 RI has shown that VOCs are present in the soil-vapor beneath JPL (Foster Wheeler, 1999). Results indicated that CCl_4 and TCE in soil-vapor extend to the groundwater table beneath the north-central portion of JPL, which is consistent with on-site groundwater plume emanations identified in the OU-1/OU-3 RI. In addition, the OU-2 data indicated that PCE and 1,2-DCA were detected very infrequently, and at very low concentrations in JPL soil-vapor samples. This is also consistent with the low levels of PCE and 1,2-DCA, and relatively small number of PCE and 1,2-DCA detects, in on-site groundwater.

With regard to inorganic compounds, ClO_4^- analysis was not conducted on JPL soil samples because when ClO_4^- was identified as a potential contaminant late in the RI program, reliable analytical methodology had not been developed for extraction and analysis of ClO_4^- in soils. However, high concentrations of ClO_4^- observed in on-site groundwater suggest that JPL is a source of ClO_4^- .

Low levels of Cr(VI) (up to 0.28 mg/kg), were detected during the OU-2 RI in only one soil boring, No. 29, which is just south of the Southern California Edison Substation located near the southern edge of JPL (Figure 1-2). This boring is located over 1,000 feet downgradient of groundwater monitoring wells MW-7 and MW-13, which are the only wells where Cr(VI) has been frequently detected in the groundwater during the OU-1/OU-3 RI. Cr(VI) has not been detected in any of the five screens in multi-port groundwater monitoring well MW-4, which is located immediately downgradient of soil boring No. 29.

4.3.2 Potential Off-Site Contaminant Sources

Several contaminants, including TCE, PCE, and ClO_4^- were detected in upgradient JPL monitoring wells MW-14 and MW-6 during the RI, suggesting the influence of off-site sources. Although it is not within the scope of the JPL RI to conduct a full-scale investigation to identify off-site sources, relevant RI data has been reviewed in an effort to evaluate these sources to the extent possible. The conclusions reached are summarized below.

4.3.2.1 Upgradient Production Well Data

The relevant RI data consist mainly of results from analyses associated with the Valley Water Company and the La Canada Irrigation District production wells, all of which are located several thousand feet upgradient of the JPL site. Data considered in the following discussion include contaminant data and general water quality data from analyses conducted on water samples from these production wells. Several limitations were identified with regard to the direct usability of contaminant concentration data from these production wells (see Section 4.1.3). The most important of these limitations is that contaminant results probably represent low estimates due to various artifacts of production well sampling, such as dilution from very long screened intervals, and volatilization during sampling (VOCs only). These limitations are mainly with regard to direct comparisons with contaminant concentrations measured in JPL monitoring wells, and are of minor importance with regard to the following contaminant source discussion.

Contaminant Analysis

Groundwater data provided by the CA DHS and the Raymond Basin Management Board has shown the presence of TCE, PCE, and ClO_4^- in the upgradient Valley Water Company production wells at levels up to 9.6 $\mu\text{g/L}$, 290 $\mu\text{g/L}$, and 5.0 $\mu\text{g/L}$, respectively (Table 4-3). The Valley Water Company production wells are several thousand feet upgradient of upgradient JPL monitoring wells MW-14 and MW-6, and the presence of TCE, PCE, and ClO_4^- in these production wells suggests an upgradient source(s) of these compounds. Although concentrations of TCE, PCE, and ClO_4^- in the Valley Water Company samples can not be correlated directly with those measured in JPL monitoring wells (see Section 4.1.3), and probably represent low estimates, several lines of additional data support the assertion of upgradient sources.

Groundwater flow maps generated as far back as the 1930s (Department of Public Works, 1954) show that regional groundwater flow is predominantly to the southeast. The presence of TCE, PCE, and ClO_4^- in the Valley Water Company production wells can not be adequately explained by short-term reversals in the groundwater flow direction observed to originate in the vicinity of the Arroyo Seco (see Section 3.4.3). These periods of westerly groundwater flow have been observed during the RI to be relatively brief, and have not been shown to transport contaminants several thousand feet upgradient, a distance which is similar (in many cases) to downgradient contaminant migration distances. However, if past flow reversals were significant enough to account for the TCE, PCE and ClO_4^- in the upgradient monitoring wells (MW-14 and MW-6) and the Valley Water Company production wells, CCl_4 would also be expected to be present in one or more of these wells. However, the data indicate that this has not occurred.

It is noted that it may be argued that ClO_4^- , which purportedly is more mobile than VOCs in groundwater, may potentially migrate further up-gradient than CCl_4 . However, the rates of migration of TCE and PCE are expected to be comparable with that of CCl_4 , based on the similarity of the octanol/water partition coefficients (expressed as $\text{Log } K_{ow}$): 2.5, 2.5, 2.7, respectively. $\text{Log } K_{ow}$ values are used to estimate the potential for an organic compound to adsorb to soil materials (see Section 5.2), and therefore give an indication of the compound's mobility. Because these three compounds are structurally similar, and their $\text{Log } K_{ow}$ values are

comparable, migration rates can be expected to be very similar. It is therefore very unlikely that PCE and TCE, but not CCl_4 would have migrated into the vicinity of the up-gradient wells.

General Water Chemistry Analysis

General water chemistry data was evaluated in an effort to better understand flow patterns and water types beneath JPL and the surrounding area (see Section 3.4.2). As a result of this analysis, an upgradient, off-site water type (water Type 3) was identified, which differed chemically from the water types observed primarily beneath JPL (water Types 1 and 2). Water Type 3 is characterized as having TDS levels elevated over those of water Types 1 and 2, and containing comparatively high levels of sulfate and chloride (see Section 3.4.2). It was shown (Section 3.4.2) that the Colorado River water historically injected into the aquifer at the Valley Water Company wells for groundwater recharge purposes (see Section 4.1.4) has high TDS, and elevated levels of sulfate and chloride. The data suggest that water Type 3 is present in the aquifer as a result of injecting the Colorado River water (see Section 3.4.2).

Furthermore, water Type 3 is exclusively observed in the study area downgradient from the vicinity of the Valley Water Company wells (see Figures 3-14 and 3-15). Results from water quality analysis from the La Canada Production Well No. 1, which is directly upgradient from the Valley Water Company wells, are similar to those of water Type 1. The fact that water Type 3 appears to result from injection of Colorado River water by the Valley Water Company is important for two reasons: (1) it underscores the predominance of the regional southeast groundwater flow direction, and (2) it provides evidence that the historic injections of Colorado River water upgradient of JPL have influenced the basin.

4.3.2.2 Potential Sources

Because TCE and PCE are commonly used in a variety of commercial applications such as dry cleaning or degreasing, it is suspected that the source(s) of the TCE and PCE in the upgradient production wells is due to upgradient commercial use. Information regarding the location of potential upgradient sources, the extent of their influence, or their proximity to the Valley Water Company wells is currently unavailable.

The nature of the upgradient ClO_4^- source(s) is also unclear at this time, however, the most likely explanation appears to be the injection of Colorado River water by the Valley Water Company into the aquifer, which (as discussed above) is believed to influence downgradient groundwater quality in the basin, and has recently been found to contain ClO_4^- . The ClO_4^- contamination in the Colorado River has been associated with the manufacture and disposal of ammonium perchlorate (NH_4ClO_4) at two facilities near Henderson, Nevada (no other sources have been identified to date). Concentrations of ClO_4^- have recently been measured up to 16 $\mu\text{g/L}$ in the Colorado River (Mayer, 1998) but past concentrations can not be known. Given that discharge of NH_4ClO_4 into the Colorado River may be decreasing or is no longer occurring, and that significant dilution has likely occurred over several years, the fact that ClO_4^- persists in the Colorado River may suggest that much higher levels, or pulses may have been present.

The introduction of ClO_4^- into the aquifer via upgradient injection of Colorado River water explains the presence of ClO_4^- in the upgradient Valley Water Company production wells. It's also important to note that ClO_4^- is present, along with off-site water Type 3, in two of the deeper screens in JPL upgradient well MW-14 (Screens 2 and 3), which are located downgradient from the screened intervals of the Valley production wells. This again suggests the presence of an upgradient, off-site source(s) of ClO_4^- .

4.3.3 Summary

Analysis of soil-vapor conducted during the OU-2 RI has confirmed on-site sources of CCl_4 and TCE beneath the north-central portion of the site. Perchlorate analysis was not conducted on JPL soil samples because methodology had not been developed for analysis of ClO_4^- in soils when ClO_4^- was identified as a potential contaminant. Low levels of Cr(VI) were detected in soil samples from one soil boring, but appeared to be unrelated to the Cr(VI) detected in monitoring wells MW-7 and MW-13 during the OU-1/OU-3 RI.

TCE, PCE, and ClO_4^- were detected in upgradient municipal production wells suggesting the presence of upgradient, off-site sources for these contaminants. Although it is not appropriate for JPL to directly investigate off-site sources, relevant RI data and other existing data were reviewed to evaluate these sources to the extent possible. Discharge by commercial industry (dry cleaners, etc.) is suspected as the upgradient source of TCE and PCE, and injection of Colorado River Water, which has recently been found to contain ClO_4^- , into the aquifer via the Valley Water Company production wells (for groundwater recharge purposes) is suspected as the upgradient source of ClO_4^- .

4.4 QUALITY ASSURANCE/QUALITY CONTROL

This section describes the specific quality control (QC) checks that were implemented for the RI to comply with the requirements of the project as proposed in the project Quality Assurance Program Plan (QAPP) (Ebasco, 1993g) and to ensure that the project data quality objectives (DQOs) were met. The QC checks included field quality assurance/quality control (QA/QC) samples, laboratory QC samples, blind performance evaluation samples, and data validation.

4.4.1 Data Quality Objectives

The data quality objectives (DQOs) development process is described in the project QAPP (Ebasco, 1993g). Because similar investigative activities occurred at OU-1 and OU-3, the DQOs are inclusive for both units. The fundamental goals of the project DQOs were to acquire data of sufficient quantity and quality to accomplish the following tasks:

- Define the nature and the horizontal and vertical extent of the constituents of interest in the groundwater.
- Develop a more comprehensive understanding of the dynamic nature of groundwater flow and impact from nearby municipal production wells.

- Support a risk assessment and address significant exposure pathways.
- Support decisions for potential remedial alternatives and remedial design.

All data were reviewed for acceptable quality and usability in support of environmental management decisions on future action. An assessment of data quality sufficient to support the objectives of this RI required that key data quality characteristics be reviewed and evaluated. In this case, the key criteria for assessing data quality are precision, accuracy, representativeness, comparability and completeness.

Precision is a measure of the degree to which two or more replicate measurements are in agreement. Precision is an important component in the assessment of data quality because it indicates the extent to which random errors affect the final results. These random errors occur due to variation in observations, electronics and procedures. The overall precision achieved by a measurement system is both a function of the field sample collection techniques and the laboratory analytical protocol. For the purpose of data quality assessment, and in accordance with Section 4.1.1 of the QAPP, precision was determined by calculating a relative percent difference (RPD) between field duplicate and matrix spike/matrix spike duplicate (MS/MSD) pairs. Data from repetitive analysis of calibration standards were also generated to assess the laboratory's analytical precision in terms of percent differences (%D) and relative standard deviations (RSD) of instrument response factors calculated for each analyte. Results obtained from analyzing these types of control samples were reviewed during the formal data validation process to assess system variability in terms of RPD, %D, and RSD. Based on published method requirements, and data validation guidelines, precision is generally expected to be less than 20-30%, depending on the type of control sample used to determine variability. In this case, RPDs calculated from field duplicate and MS/MSD pairs are used to assess system precision, while %D and RSD are calculated from calibration standards to assess laboratory analytical precision.

Accuracy is the degree of agreement between an observed value and an accepted reference value. It is a measure of the correctness of the result and generally depends on collecting representative samples, handling them properly to avoid contamination or degradation, and how well the laboratory controls and compensates for systematic errors that may arise from impure standards, errors in the preparation of reagents and standards, and procedural errors in weighing, diluting, and calculating results. Sampling accuracy is assessed by generating data from field blanks and trip blanks, and adhering closely to all sampling equipment, handling, preservation and holding time criteria. Accuracy is determined quantitatively by calculating a percent recovery (%R) from samples spiked with target analytes (MS/MSD) and, for organic analytes, with surrogate compounds. In accordance with method requirements, laboratory accuracy was also assessed from %R results generated from periodic analysis of calibration check standards (CCS), laboratory control samples (LCS), and performance evaluation (PE) samples of known concentrations. Depending on the type of control sample, accuracy is generally expected to fall within a range of ± 10 -30% of the accepted reference value.

Representativeness is the degree to which sample data accurately and precisely represent a particular characteristic of the population or environmental condition. Representativeness in the collection of samples is achieved through careful selection of their location, distribution, frequency, and the techniques employed in sampling. Although representative samples of a liquid matrix (e.g., groundwater) are not as affected by the spatial variability typical of soils, representativeness cannot be assured without consistent and precise implementation of the approved field and laboratory procedures. The RI/FS Work Plan and the OU-1/OU-3 FSAP address these issues. In the laboratory, representativeness is assured by consistent implementation of standard analytical methods performed in a timely manner that achieve appropriate detection limits. Although representativeness is generally treated as a qualitative criterion (pass or fail), it may be demonstrated in a quantitative way by examining field duplicate results.

Comparability is an evaluation of the similarity of conditions under which different sets of data are produced. Comparability expresses the confidence with which one data set may be compared to another, and is therefore a qualitative criterion. To achieve comparability, a documented regimen of standard, approved methods, procedures, and techniques was implemented to collect, package, transport, prepare and analyze samples, and report the data. The same laboratory facilities were used to generate the analytical data, and laboratory audits were conducted to observe analytical techniques and assure technical compliance with published methods, standard operating procedures, and good laboratory practices.

Completeness is the percentage of measurements reported whose final results are judged to be valid. To meet the completeness criterion for acceptable data quality, a minimum of 90% completeness was required by Section 4.1.5 of the QAPP.

4.4.2 Field Quality Assurance/Quality Control

QC samples were collected for each sampling event in support of the RI. The field QC samples included trip blanks, equipment blanks, and field blanks, as well as duplicate groundwater samples.

Trip blank samples accompanied water samples for VOC analysis to assess potential cross contamination between samples resulting from sample shipment and storage. A total of 224 trip blanks were shipped and analyzed during the RI. Detection of known laboratory contaminants (acetone, methylene chloride, and toluene), chloroform, fluorotrichloromethane, carbon disulfide, xylene, toluene, tetrahydrofuran, and acetic acid were reported in some of the trip blank samples. These compounds were also reported in laboratory method blank samples and, therefore, are not related to groundwater. Only two compounds, chloroform and acetone (also a common laboratory contaminant), were detected occasionally in both trip blank samples and associated groundwater samples. Detection of these "trip blank associated compounds" in the groundwater samples has been qualified in the data summary tables using a "TB." In light of this information, it is concluded that, overall, trip blank sample results suggest that no cross contamination of groundwater samples occurred during sample shipment and storage at the laboratory.

Equipment rinse blanks were collected for each day of sampling during the RI when the non-dedicated Westbay sampling equipment was used at the multi-port wells. The equipment rinse blanks were used to assess potential cross contamination between the sampling ports for the different screen depths in the deep wells. A total of 211 equipment blanks were collected and analyzed during the RI. Low-level detections of copper, zinc, lead, nickel, aluminum, 2,4-bis(1,1-dimethylethyl)phenol, carbon disulfide, acetone, chloroform, methylene chloride, tetrahydrofuran, toluene, xylene, and phthalates were reported in some of the equipment blank samples, laboratory method blank samples, and the water the laboratory supplied for the equipment rinse blanks. However, all concentrations were below MCLs and CA DHS action levels. Only one rinse blanks, collected during the November/December 1994 sampling event prior to sampling MW-4 screen 2, contained low-level concentrations of carbon tetrachloride and trichloroethene. Detection of equipment blank associated constituents in the groundwater samples has been qualified in the data summary tables using an "EB". Overall, equipment blank samples indicate that decontamination procedures were effective in preventing cross-contamination during sampling.

One field blank sample was collected and analyzed for all constituents each sampling event to assess potential contamination during field sampling activities. Seven anomalous detections were reported in field blank samples during the RI. These included one low-level detection each of 2-methylpropene, 2,4-bis(1,1-dimethylethyl)phenol, acetone, aluminum, and ethylbenzene and two detections of lead at the method reporting limit. Field blank data indicate no impact to the constituents of interest in groundwater samples occurred as a result of environmental conditions present during field sampling activities.

Field duplicate samples were collected and analyzed for groundwater sample parameters to assess the precision associated with the sampling and the laboratory analysis. A total of 44 field duplicate samples were collected during the RI, or approximately 8 percent of the 510 total number of samples. The project objective of 5 percent field duplicate samples was therefore achieved.

An evaluation of the relative percent difference (RPD) values for the field duplicate samples indicated 98 percent of the RPD values for metals and inorganic data were within the 30 percent RPD specified in the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1994a). The RPD summary for the organic data indicated 93 percent of the values were within 30 percent RPD. The field duplicate data therefore indicate a high level of precision associated with the field sampling and laboratory analyses.

4.4.3 Analytical Methods and Laboratory Quality Control/Quality Assurance

Groundwater samples for the RI were analyzed for VOCs, SVOCs, total and dissolved Title 26 metals plus Sr and Al, Cr(VI), CN⁻, TBT, ClO₄⁻, TPH, gross alpha/beta, and general minerals. The analyses performed for each sampling event are summarized in Table 4-1.

Montgomery Watson Laboratories in Pasadena, California, performed the chemical analyses. Table 4-2 presents the analytical methods, analyte list, and detection limits for the groundwater samples. Analytical methods for chemical analysis are taken from the *USEPA Methods for the Determination of Organic Compounds in Drinking Water, Manual 600/4-90/020* (EPA, 1990); *USEPA SW-846 Test Methods for Evaluating Solid Waste, Final Update No. III* (EPA, 1996a); *USEPA Methods for Chemical Analysis of Water and Wastes, Manual 600/4-79-020* (EPA, 1979); and Montgomery Watson Laboratory performance demonstrated methods.

In addition to the field QA/QC procedures, the laboratory is required to perform a variety of QA/QC checks for every analytical run to ensure that the instruments are operating properly, and that results are accurate. The most important of these include: method blanks, matrix spikes, and laboratory control samples. Following is a brief description of each of these checks.

A method blank consists of pure (deionized) water containing all of the reagents (at their respective concentrations) used in the analytical procedure. Method blanks are treated and analyzed in the same manner as the groundwater samples. If a contaminant detected in a groundwater sample is also present in the associated method blank, its presence in the groundwater sample can be attributed to laboratory contamination.

Matrix spikes are defined as the sample matrix (JPL groundwater) spiked with method-specific target compounds to specific concentrations. Matrix spike samples (and matrix spike duplicates) are analyzed along with the groundwater samples. Based on the amount of each target compound recovered, conclusions can be drawn as to whether the groundwater matrix interferes with the analysis.

Laboratory control samples consist of deionized water spiked with method-specific target compounds to specific concentrations. These samples are analyzed along with the groundwater samples for each analytical run. This procedure is implemented to provide baseline performance data for the analysis, and to insure the accuracy of the instrument.

Laboratory QA/QC data is collected for all analytical runs for every sampling event. The data is evaluated by laboratory QA/QC personnel, and is required to meet US EPA Contract Laboratory Program Level (CLP) Level IV criteria, which is the EPA's most stringent criteria. Furthermore, CLP Level IV criteria require that all QA/QC results, including raw data and instrument performance evaluation information be supplied along with analytical results, in order that independent data validation can be carried out.

4.4.4 Performance Evaluation Samples

Performance evaluation (PE) samples are water samples specially prepared to contain known concentrations of constituents of concern that are then submitted for analyses to the laboratory along with groundwater samples. PE samples are used as an independent check on the accuracy of the laboratory. One PE sample for VOC analysis was submitted to the laboratory (Montgomery Watson Laboratories) during each of the last two RI sampling events

(September/October, 1997 and January/February, 1998). The samples were prepared by Environmental Resource Associates, a company specializing in providing such services located in Arvada, Colorado. The samples were obtained by a representative of JPL and given to Foster Wheeler for submittal to the laboratory with other groundwater samples. Foster Wheeler did not know the contents of the PE samples. Results of the analyses of the PE samples and the original contents of the PE samples are shown on Table 4-14.

Results of PE sample analyses show that the laboratory (Montgomery Watson Laboratories) is capable of accurately measuring VOC concentrations in aqueous media and provided accurate data for the RI.

4.4.5 Data Validation

In addition to the QA/QC procedures described above, VOC, SVOC, metals, and perchlorate data were periodically evaluated by Laboratory Data Consultants (LDC), a company located in San Juan Capistrano, California, specializing in providing such services. LDC was subcontracted directly by JPL to perform data validation. Validation of data involves trained professionals reviewing appropriate laboratory documentation on instrument performance, analyte identification and quantitation procedures, QA/QC, etc. pursuant to regulatory agency guidance. During the RI, one hundred percent of the June/July, 1994, September/October, 1997, and January/February, 1998 data were validated, and approximately 10 percent of the November/December, 1994 data and approximately 20 percent of the July/August, 1995 and December/January, 1995-96 data were validated. After LDC completed the data validation and submitted their results, senior Foster Wheeler chemists reviewed the reports and prepared data validation summary reports (Foster Wheeler, 1996i, 1996j, 1997e, 1997f, 1998f, and 1998g). In addition, a team of Foster Wheeler chemists, project managers, and a JPL QA officer performed two audits of Montgomery Watson Laboratories during the RI, one in June/July, 1994 (Ebasco, 1994c) and the other in September, 1997 (Foster Wheeler, 1997d), in which no significant issues were identified that would impact the quality or use of the data from the laboratory for the RI.

Data validation was performed by LDC in accordance with the following documents as applicable to each analytical method:

- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February, 1994 (EPA, 1994a).
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February, 1994 (EPA, 1994b).
- USEPA SW-846 Test Methods for Evaluating Solid Waste, Final Update No. III (EPA, 1996a).
- JPL RI/FS, Quality Assurance Program for Performing a Remedial Investigation for the National Aeronautics and Jet Propulsion Laboratory, December 1993 (Ebasco, 1993g).

The validation criteria for the following data requirements were reviewed:

- Sample holding times
- Gas Chromatography/Mass Spectrometry (GC/MS) instrument performance checks
- Initial calibration results
- Continuing calibration results
- Laboratory Method Blanks
- Surrogate spike recoveries
- Matrix spike/matrix spike duplicate results
- Laboratory control sample results
- Interference check sample results (metals)
- Furnace atomic absorption QC
- Internal standards
- Target compound identification
- Compound quantitation/reporting limits
- Tentatively identified compounds
- System performance
- Field, trip, and equipment rinse blanks results

Following the data validation procedure, the appropriate validation qualifiers were applied to the analytical data. The qualifiers used included J, UJ, and R as follows:

- J – The reported positive value or concentration is considered to be an estimate based on associated QC data.
- UJ – For non-detect data the detection limit is considered to be estimated based on associated QC data.
- R – The value is considered unreliable and is unusable based on associated QC data.

4.4.6 Data Assessment

As a result of the RI data validation procedures for VOCs, SVOCs, perchlorate, and metal analyses, 0.3 percent of the validated groundwater analytical results for the RI were J-qualified, 3.5 percent were UJ-qualified, and 2.2 percent were R-qualified, signifying estimated, estimated non-detect, and rejected values, respectively (Table 4-15). The VOC, SVOC, perchlorate, and metals samples that were validated during the RI are indicated on the data summary tables (Tables 4-6, 4-8, 4-9 and 4-11) along with the data qualifiers that were generated.

The percent of J-qualified data is based on the number of estimated validated analytical values (62) compared to the total number of validated groundwater data values (21,696) for the program. A vast majority of the J-flagged data are metals results, particularly zinc and strontium, from the first RI sampling event in June 1994 (Table 4-15). No validated chromium [Cr(III) and Cr(IV)] data, the primary metal of interest, received a J-flag. Analytical data received the J-flag based on the following typical validation findings:

- The concentration of the analyte in the sample exceeded the instrument calibration range.
- The percent recovery (%R) for an analyte in the matrix spike sample or laboratory standard was outside the control limit.
- The %R for a surrogate compound was outside the control limit.
- The chromatographic response for internal standards exceeded the internal standard area limit.
- The percent difference (%D) between the initial and continuing calibration response factor exceeded the control limit.

The percent of estimated detection limits for non-detect data (UJ-qualified data) is based on the number of estimated non-detect validated analytical values (764) compared to the total number of validated groundwater sample data values (21,696) for the program. Close to 4 percent of the validated groundwater data was UJ-qualified (estimated non-detect). As shown on the RI data summary tables (Tables 4-6, 4-8, 4-9 and 4-11) few of the constituents of interest received UJ-flags. Analytical data received the UJ-flag based on the following general validation findings:

- The percent relative standard deviations (RSDs) for analytes were greater than the control criteria.
- The percent RSD of the response factors for the initial calibration was outside the control criteria.
- The %D between the initial and continuing calibration relative response factors (RRFs) for analytes was greater than the control limit.
- The %D between the initial and continuing calibration RRFs exceeded the control criteria.
- The percent RSDs were greater than the control criteria.
- The %R for surrogates was outside the acceptable control limits.
- The %R for matrix spike samples and laboratory control samples were below the control criteria.
- The %R in standard addition control sample spikes was below the acceptable control limit.
- Post-digestion spike samples were outside the control limits.

The percent of R-qualified data is based on the number of rejected analytical results (481) compared to the total number of validated groundwater sample data (21,696) for the program. Approximately 2 percent of the validated groundwater data was R-qualified. Most of the R-qualified data were from select non-detect VOC results including 2-butanone, 2-chloroethylvinylether, 2-hexanone, acetone and chloroethane from the first RI sampling event in June/July, 1994. Of the VOC, SVOC, perchlorate, and metal constituents detected during the RI and summarized on the data summary tables (Tables 4-6, 4-8, 4-9 and 4-11) only 13 total SVOC and metals non-detect results were R-qualified. These rejected non-detects included two non-detect di-n-butylphthalate results, seven non-detect arsenic results and four non-detect lead

results. A discussion regarding whether rejected non-detect results indicate that the constituent may have possibly been present is relevant here. With the exception of acetone, the VOCs mentioned above were not subsequently detected in any samples during the RI, strongly suggesting that VOCs were truly non-detect, and the non-detect results were rejected for QA/QC nonconformance not necessarily indicative of a positive result. Low concentrations of acetone have been detected throughout the RI infrequently and sporadically in various samples (groundwater as well as field and laboratory QA/QC), and this has been attributed to laboratory contamination. With regard to the two R-qualified non-detect results for di-n-butylphthalate (Table 4-8), this compound was not detected at either location during the previous sampling event and, in the previous event, the non-detect values were not qualified during data validation, indicating the compound is most likely not present and again, the non-detect results were rejected for QA/QC nonconformance, not necessarily indicative of a positive result. In the case of Pb and As, neither metal was detected during the RI at the sampling locations where the non-detect values were R-qualified (with the exception of one As result) (Table 4-11), again, suggesting that the few qualified non-detect results were rejected for QA/QC nonconformance, and were not necessarily indicative of a positive result. The R-qualifiers were based on the following general validation findings:

- The RRFs for the initial and/or continuing calibration fell below the control limit.
- The %R for the matrix spike/matrix spike duplicate (MS/MSD) samples were zero or negative.
- The %R in laboratory control samples was outside the control limits.
- The %R for surrogate compounds was outside the control criteria.

4.4.7 Data Usability

In meeting all analytical method-specific precision and accuracy performance criteria for generating data of acceptable quality, the RI results are considered of sufficient quality to support a decision or action in terms of the specific DQOs established for the project. In addition, a review of data from field duplicates and blanks indicate that sample collection was sufficiently precise and unbiased so as not to significantly impact the quality of the results. Precision and accuracy results met or surpassed satisfactory performance levels in all but 6% of the data, where, during data validation and further independent data review, data qualifiers were applied. In this case, 94% of the data remained unqualified and is fully useful for all purposes intended. However, only 2.2% of all data were rejected as unusable. Therefore, completeness is 97.8%, a very high proportion that surpasses the project goal of at least 90%, and demonstrates that project measurement data are sufficiently complete. Another 3.8% of the data set were qualified as estimated (J and UJ). However, estimated (qualitative) data is still beneficial as long as the frequency of occurrence is relatively low, as in this case.

Satisfying the representativeness and comparability criteria was assured by:

- Sampling at fixed locations based on an environmentally sound well field design.
- Employing standard well purging and field sampling procedures systematically from one location and depth interval to the next.
- Using the same laboratory subcontractor to prepare, analyze and report groundwater and associated QC sample results during each RI event.
- Carefully implementing work plans (e.g., the project-specific FSAP, QAPP, laboratory SOPs, etc.), using experienced scientists and technicians under proper supervision.

In evaluating the usefulness of this data set, no statistical hypotheses or data quality assessment parameters were applied other than those already called for by the appropriate analytical protocol and the laboratory's QAPP. The results were not corrected for bias and are reported in standard units down to the detection limits called for in project plans.

TABLE 4-1

**SUMMARY OF OU-1/OU-3 SAMPLING EVENTS
JET PROPULSION LABORATORY**

Analyses Performed	RI Sampling Event									
	OU-1 June/July 1994 MW-1, MW-3 thru MW-16	OU-1 Nov./Dec. 1994 MW-1, MW-3 thru MW-16	OU-3 July/Aug. 1995 MW-17 thru MW-21	OU-3 Dec./Jan. 1995-96 MW-17 thru MW-21	OU-1/OU-3 Aug./Sept. 1996 MW-1, MW-3 thru 21	OU-1/OU-3 Oct./Nov. 1996 MW-1, MW-3 thru 21	OU-1/OU-3 Feb./Mar. 1997 MW-1, MW-3 thru 21	OU-1/OU-3 June/July 1997 MW-1, MW-3 thru 21	OU-1/OU-3 Sept./Oct. 1997 MW-1, MW-3 thru 24	OU-1/OU-3 Jan./Feb. 1998 MW-1, MW-3 thru 24
VOCs (Method 524.2)	X	X	X	X	X	X	X	X	X	X
SVOCs (Method 8270)	X	X	X	X	MW-12-2 only	(3)				
SVOCs (Method 525.1)(1)		X(2)	X	X	(3)					
Title 26 Metals plus Strontium	X (plus filtered)	X (plus filtered)	X (plus filtered)	X (plus filtered)	(4)					
Aluminum		X(2) (plus filtered)	X (plus filtered)	X (plus filtered)	X	(4)				
Chromium, Lead and Arsenic					X(5)	X	X	X	X	X
Hexavalent Chromium	X (plus filtered)	X	X (plus filtered)	X (plus filtered)	X	X	X	X	X	X
Cyanide	X	X	X	X	(4)					
Gross Alpha/Gross Beta	MW-13 only	MW-13 only	(3)							
Total Petroleum Hydrocarbons	MW-4 only	MW-4 only	(3)							
Perchlorate								X(2)	X	X
Tributyltin					MW-12-1, MW-12-2, MW-13 only(2)	MW-12-2, MW-13 only	MW-12-1, MW-12-2, MW-13 only	MW-4-1, MW-4-2, MW-12-1, MW-12-2, MW-13 only	MW-8 only	(3)
General Minerals	X	X	X	X	X	X	X	X	X	X

(1): Analyses for benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, di(2-ethylhexyl)phthalate, hexachlorobenzene, and pentachlorophenol only.

(2): Analyses added to the sampling program at the request of EPA, DTSC and RWQCB.

(3): Based on analytical results, analyses were discontinued with approval from EPA, DTSC and RWQCB.

(4): Analyses discontinued based on health risk screening and approval from EPA, DTSC and RWQCB.

(5): Based on health risk screening (see comment 4) only sampling for these metals were continued with approval from EPA, DTSC and RWQCB.

TABLE 4-2
SUMMARY OF LABORATORY ANALYSES AND SAMPLE
CONTAINERS FOR GROUNDWATER SAMPLES
JET PROPULSION LABORATORY

Parameter	Method	Container	Preservative	Maximum Holding Time	Detection Limits
Volatile Organic Compounds	EPA 524.2	3x40 ml amber vial	4 drops HCl to pH <2; Cool to 4°C	7 days	
Benzene					0.5 µg/l
Vinyl chloride					0.5 µg/l
Carbon tetrachloride					0.5 µg/l
1,2-Dichloroethane					0.5 µg/l
Trichloroethylene					0.5 µg/l
1,4-Dichlorobenzene					0.5 µg/l
1,1-Dichloroethylene					0.5 µg/l
1,1,1-Trichloroethane					0.5 µg/l
Bromobenzene					0.5 µg/l
Bromodichloromethane					0.5 µg/l
Bromoform					0.5 µg/l
Bromomethane					0.5 µg/l
Chlorobenzene					0.5 µg/l
Chlorodibromomethane					0.5 µg/l
Chloroethane					0.5 µg/l
Chloroform					0.5 µg/l
Chloromethane					0.5 µg/l
o-Chlorotoluene					0.5 µg/l
p-Chlorotoluene					0.5 µg/l
Dibromomethane					0.5 µg/l
1,3-Dichlorobenzene					0.5 µg/l
1,2-Dichlorobenzene					0.5 µg/l
trans-1,2-Dichloroethylene					0.5 µg/l
cis-1,2-Dichloroethylene					0.5 µg/l
Dichloromethane					0.5 µg/l
1,1-Dichloroethane					0.5 µg/l
1,1-Dichloropropene					0.5 µg/l
1,2-Dichloropropane					0.5 µg/l
1,3-Dichloropropane					0.5 µg/l
cis-1,3-Dichloropropene					0.2 µg/l
trans-1,3-Dichloropropene					0.5 µg/l
2,2-Dichloropropane					0.5 µg/l
Ethyl benzene					0.5 µg/l
Styrene					0.5 µg/l
1,1,2-Trichloroethane					0.5 µg/l
1,1,1,2-Tetrachloroethane					0.5 µg/l
1,1,2,2-Tetrachloroethane					0.5 µg/l
Tetrachloroethylene					0.5 µg/l
1,2,3-Trichloropropane					0.5 µg/l
Toluene					0.5 µg/l
m,p-Xylenes					0.5 µg/l
o-Xylene					0.5 µg/l
Bromochloromethane					0.5 µg/l
n-Butylbenzene					0.5 µg/l
Dichlorodifluoromethane					0.5 µg/l
Fluorotrichloromethane					0.5 µg/l
Hexachlorobutadiene					0.5 µg/l
Isopropylbenzene					0.5 µg/l
p-Isopropyltoluene					0.5 µg/l
Naphthalene					0.5 µg/l
n-Propylbenzene					0.5 µg/l
sec-Butylbenzene					0.5 µg/l

TABLE 4-2
SUMMARY OF LABORATORY ANALYSES AND SAMPLE
CONTAINERS FOR GROUNDWATER SAMPLES
JET PROPULSION LABORATORY

Parameter	Method	Container	Preservative	Maximum Holding Time	Detection Limits
tert-Butylbenzene					0.5 µg/l
1,2,3-Trichlorobenzene					0.5 µg/l
1,2,4-Trichlorobenzene					0.5 µg/l
1,2,4-Trimethylbenzene					0.5 µg/l
1,3,5-Trimethylbenzene					0.5 µg/l
2-Butanone (MEK)					5.0 µg/l
4-Methyl-2-Pentanone					5.0 µg/l
Trichlorotrifluoroethane					0.5 µg/l
Title 26 Metals plus Strontium (Sr) and Aluminum (Al)		500 ml Polyethylene	2 ml HNO ₃ to pH <2; Cool to 4°C		
Silver (Ag)	6010			6 months	10 µg/l
Aluminum (Al)	200.7			6 months	25 µg/l
Arsenic (As)	206.2			6 months	5 µg/l
Barium (Ba)	6010			6 months	50 µg/l
Beryllium (Be)	6010			6 months	4 µg/l
Cadmium (Cd)	6010			6 months	5 µg/l
Chromium (Cr)	6010			6 months	10 µg/l
Cobalt (Co)	6010			6 months	50 µg/l
Copper (Cu)	6010			6 months	10 µg/l
Mercury (Hg)	245.1			28 days	2 µg/l
Molybdenum (Mo)	6010			6 months	50 µg/l
Nickel (Ni)	6010			6 months	40 µg/l
Lead (Pb)	239.2			6 months	2 µg/l
Antimony (Sb)	204.2			6 months	6 µg/l
Selenium (Se)	270.2			6 months	5 µg/l
Thallium (Tl)	279.2			6 months	2 µg/l
Vanadium (V)	6010			6 months	50 µg/l
Strontium (Sr)	6010			6 months	10 µg/l
Zinc (Zn)	6010			6 months	20 µg/l
Major Cations					
Calcium (Ca)	215.1			6 months	1000 µg/l
Magnesium (Mg)	242.1			6 months	1000 µg/l
Sodium (Na)	273.1			6 months	1000 µg/l
Potassium (K)	258.1			6 months	1000 µg/l
Iron (Fe)	200.7/6010			6 months	100 µg/l
Chromium (Hexavalent)	7196	125 ml Polyethylene	Cool to 4°C	24 hours	5 µg/l
Cyanide	335.3	125 ml Polyethylene	0.5 ml of 50% NaOH to pH >12; Cool to 4°C	14 days	5 µg/l
Perchlorate	300 mod.	125 ml Polyethylene	Cool to 4°C	28 days	4 µg/l
Tributyltin	GC/FPD	3x1L amber glass	Cool to 4°C	35 days	0.002 µg/l
Major Anions		500 ml Polyethylene	Cool to 4°C		
Alkalinity	310.1			14 days	2 mg/l
Chloride	300			28 days	1000 µg/l
Sulfate	300			28 days	2000 µg/l
Nitrate (as N)	300			48 hours	100 µg/l
Total Dissolved Solids	160.1			7 days	10 mg/l
pH	150.1	—	—	field	0.01 units
Specific Conductance	120.1	—	—	field	4 umhos/cm

TABLE 4-2
SUMMARY OF LABORATORY ANALYSES AND SAMPLE
CONTAINERS FOR GROUNDWATER SAMPLES
JET PROPULSION LABORATORY

Parameter	Method	Container	Preservative	Maximum Holding Time	Detection Limits
Semi-Volatile Organic Compounds	EPA 8270	2x1000 ml glass	Cool to 4°C	Extraction w/in 14 days; Analysis w/in 40 days	
Phenol					10 µg/l
bis(2-chloroethyl)ether					10 µg/l
2-Chlorophenol					10 µg/l
1,3-Dichlorobenzene					10 µg/l
1,4-Dichlorobenzene					10 µg/l
Benzyl Alcohol					10 µg/l
1,2-Dichlorobenzene					10 µg/l
2-Methylphenol					10 µg/l
bis(2-chloroisopropyl)ether					10 µg/l
4-Methylphenol					10 µg/l
N-nitroso-di-n-dipropylamine					10 µg/l
Hexachloroethane					10 µg/l
Nitrobenzene					10 µg/l
Isophorone					10 µg/l
2-Nitrophenol					10 µg/l
2,4-Dimethylphenol					10 µg/l
Benzoic Acid					50 µg/l
bis(2-chloroethoxy)methane					10 µg/l
2,4-Dichlorophenol					10 µg/l
1,2,4-Trichlorobenzene					10 µg/l
Naphthalene					10 µg/l
4-Chloroaniline					10 µg/l
Hexachlorobutadiene					10 µg/l
4-Chloro-3-methylphenol					10 µg/l
2-Methylnaphthalene					10 µg/l
Hexachlorocyclopentadiene					10 µg/l
2,4,6-Trichlorophenol					10 µg/l
2,4,5-Trichlorophenol					50 µg/l
2-Chloronaphthalene					10 µg/l
2-Nitroaniline					50 µg/l
Dimethylphthalate					10 µg/l
Acenaphthylene					10 µg/l
2,6-Dinitrotoluene					10 µg/l
3-Nitroaniline					50 µg/l
Acenaphthene					10 µg/l
2,4-Dinitrophenol					50 µg/l
4-Nitrophenol					50 µg/l
Dibenzofuran					10 µg/l
2,4-Dinitrotoluene					10 µg/l
Diethylphthalate					10 µg/l
4-Chlorophenyl-phenyl ether					10 µg/l
Fluorene					10 µg/l
4-Nitroaniline					50 µg/l
4,6-Dinitro-2-methylphenol					50 µg/l
N-nitrosodiphenylamine					10 µg/l
4-Bromophenyl-phenylether					10 µg/l
Hexachlorobenzene					10 µg/l
Pentachlorophenol					50 µg/l
Phenanthrene					10 µg/l
Anthracene					10 µg/l

TABLE 4-2
SUMMARY OF LABORATORY ANALYSES AND SAMPLE
CONTAINERS FOR GROUNDWATER SAMPLES
JET PROPULSION LABORATORY

Parameter	Method	Container	Preservative	Maximum Holding Time	Detection Limits
Di-n-butylphthalate					10 µg/l
Fluoranthene					10 µg/l
Pyrene					10 µg/l
Butylbenzylphthalate					10 µg/l
3,3-Dichlorobenzidine					20 µg/l
Benzo(a)anthracene					10 µg/l
Chrysene					10 µg/l
bis(2-ethylhexyl)phthalate					10 µg/l
Di-n-octylphthalate					10 µg/l
Benzo(b)fluoranthene					10 µg/l
Benzo(k)fluoranthene					10 µg/l
Benzo(a)pyrene					10 µg/l
Indeno(1,2,3-cd)pyrene					10 µg/l
Dibenzo(a, h)anthracene					10 µg/l
Benzo(g,h,i)perylene					10 µg/l
Semi-Volatile Organic Compounds	EPA 525.2	2x1000 ml glass	Cool to 4°C	Extraction w/in 7 days; Analysis w/in 40 days	
Hexachlorobenzene					0.05 µg/l
Pentachlorophenol					1.0 µg/l
Benz(a)anthracene					0.05 µg/l
Benzo(b)fluoranthene					0.02 µg/l
Benzo(a)pyrene					0.02 µg/l
Di(2-ethylhexyl)phthalate					0.6 µg/l

Notes: Method detection limits are highly matrix-dependent and may vary slightly. The detection limits listed herein are provided for guidance

(Values above state and/or Federal MCLs or IALs are bold and boxed) (When two or more results were available for any given month, the highest reported value was used for this table.)

Table4-3.xls/chart 89-on

TABLE 4-3
SUMMARY OF VOCs OF INTEREST AND PERCHLORATE DETECTED IN NEARBY MUNICIPAL PRODUCTION WELLS (1990-1998)
JET PROPULSION LABORATORY
All concentrations in µg/L

(Values above state and/or Federal MCLs or IALs are bold and boxed) (When two or more results were available for any given month, the highest reported value was used for this table.)

Municipal Well	Constituent of Concern	Date Sampled																																																							
		1994												1995												1996												1997										1998									
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar																	
City of Pasadena Arroyo Well	Carbon Tetrachloride						3.1	3.1	ND	1.3			ND			2.2	2.6		2.2	ND	2.8	2.0	ND	ND	3.5	3.2		ND	2.0	ND	ND	2.5	3.7	4.7	4.4	2.5	3.2	3.0		4.1	4.1	3.6	4.7														
	Trichloroethene						3.1	3.5	ND	2.2			ND			1.6	2.3		2.4	2.6	3.6	2.7	ND	ND	3.9	3.6		ND	1.6	ND	ND	2.2	3.6	3.9	4.0	2.8	3.5	2.9		2.9	2.7	2.2	3.5														
	1,2-Dichloroethane						ND	ND	ND	ND			ND						3.3		ND	ND	ND	ND					ND	0.2	ND	ND																									
	Tetrachloroethene						ND	ND	ND	ND			ND						ND		ND	ND	ND	ND					ND	0.7	ND	ND			0.5	0.5			0.6																		
City of Pasadena Well 52	Carbon Tetrachloride						ND	ND		ND	0.5								ND					0.5						0.5	ND			0.5	0.7	0.7																					
	Trichloroethene						1.7	1.8	1.9	1.5	2.4				1.3	1.5	1.9		2.3	2.6	3.5	3.1	3.8	3.9	4.0	3.9		5.3	4.5	ND	3.3	2.7	3.6	4.4	4.7				7.3	4.1	3.1	4.6	3.4	2.0	3.5	3.4	3.9	5.8	4.7								
	1,2-Dichloroethane						ND	ND		ND									ND											ND	ND																										
	Tetrachloroethene						ND	ND		ND									ND											0.2	ND																										
City of Pasadena Ventura Well	Carbon Tetrachloride						ND	ND		ND						ND			ND	ND				ND												ND																					
	Trichloroethene						ND	ND		ND						ND			ND	ND				ND																																	
	1,2-Dichloroethane						ND	ND		ND						ND			ND	ND				ND																																	
	Tetrachloroethene						ND	ND		ND						ND			ND	ND				ND																																	
City of Pasadena Windsor Well	Carbon Tetrachloride						ND	ND	ND	ND								ND	ND	ND	ND		ND	ND					ND							ND																					
	Trichloroethene						1.0	1.2	ND	0.9	1.6				1.2	0.8	0.9		ND	ND	0.8	ND	0.8	ND	0.1	0.7		ND	0.9	ND	0.8	ND	0.8	0.9	0.9	ND	0.8	0.8		1.2	0.9	ND	1.0			0.7		0.6	1.1	0.8							
	1,2-Dichloroethane						ND	ND	ND	ND									ND	ND	ND	ND		ND	ND				ND	ND	ND																										
	Tetrachloroethene						1.0	1.0	ND	ND	0.9				0.6	0.5	0.6		ND	0.7	0.6	ND	0.5	ND	0.8			ND	0.7	ND	1.0	ND	0.8	1.1	1.0	ND		0.6		1.0	0.8	ND	1.1		0.6	0.8	1.1	0.7									
Lincoln Avenue Well # 3	Carbon Tetrachloride								0.5	1.0	1.5							0.7	1.0	ND	ND	1.3	1.1	0.8					ND	0.6		ND	0.9	1.2	1.1	0.7	0.5				ND	0.6	ND	1.5	0.9	0.9	0.3	0.6	0.8								
	Trichloroethene								6.8	19.8	16.8							7.4	12.7	11.9	20.8	16.1	17.2	18.1					ND	10.0		ND	6.2	9.1	17.5	16.8	15.9				ND	9.6	10.5	12.7	15.2	13.2	0.3	12.4	8.8								
	1,2-Dichloroethane																		ND											ND																											
	Tetrachloroethene									0.6	1.7	1.2						ND	1.1	0.6	0.8	1.3	1.2	1.0					ND	0.6		ND	0.9	1.4	2.9	0.7	0.5				ND	0.7	0.7	1.1	1.1	1.1	0.3	0.9	0.5								
Lincoln Avenue Well # 5	Carbon Tetrachloride																																																								
	Trichloroethene																																																								
	1,2-Dichloroethane																																																								
	Tetrachloroethene																																																								
Valley Water Co. Well # 1	Carbon Tetrachloride																																																								
	Trichloroethene																																																								
	1,2-Dichloroethane																																																								
	Tetrachloroethene																																																								
Valley Water Co. Well # 2	Carbon Tetrachloride																																																								
	Trichloroethene																																																								
	1,2-Dichloroethane																																																								
	Tetrachloroethene																	</																																							

Values above state and/or Federal MCLs or IALs are bold and boxed) (When two or more results were available for any given month, the highest reported value was used for this table.)

Table4-4.xls/chart 89-on

(Values above state and/or Federal MCLs or IALs are bold and boxed) (When two or more results were available for any given month, the highest reported value was used for this table.)

Table4-4.xls/chart 89-on

TABLE 4-5

**SUMMARY OF WELL SCREENS AND AQUIFER LAYERS
JET PROPULSION LABORATORY**

Well Number	AQUIFER LAYERS			
	Layer 1	Layer 2	Layer 3	Layer 4
MW-1	X			
MW-3				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-4				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4		X		
Screen 5			X	
MW-5	X			
MW-6	X			
MW-7	X			
MW-8	X			
MW-9	X			
MW-10	X			
MW-11				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4		X		
Screen 5			X	
MW-12				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4		X		
Screen 5			X	
MW-13	X			

TABLE 4-5

**SUMMARY OF WELL SCREENS AND AQUIFER LAYERS
JET PROPULSION LABORATORY**

Well Number	AQUIFER LAYERS			
	Layer 1	Layer 2	Layer 3	Layer 4
MW-14				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-15				
	X			
MW-16				
	X			
MW-17				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-18				
Screen 1	X			
Screen 2	X			
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-19				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-20				
Screen 1	X			
Screen 2		X		
Screen 3			X	
Screen 4			X	
Screen 5				X
MW-21				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	

TABLE 4-5

**SUMMARY OF WELL SCREENS AND AQUIFER LAYERS
JET PROPULSION LABORATORY**

Well Number	AQUIFER LAYERS			
	Layer 1	Layer 2	Layer 3	Layer 4
MW-22				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-23				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	
MW-24				
Screen 1	X			
Screen 2		X		
Screen 3		X		
Screen 4			X	
Screen 5			X	

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
MW-1	Jun/Jul 1994	X	—	—	—	—	—	—	—	—	—	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	1.9(TB, EP) Acetone	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	1.9(EP) Acetone	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	1.3 m, p-Xylenes	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	1.2 Toluene	—
MW-3												
Screen 1	Jun/Jul 1994	X	—	—	—	—	—	—	—[U]	—	0.9 Toluene	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	1.2(TB)	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	8.3	0.7(B) Naphthalene	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	2.6(EP) Carbon Disulfide	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	—	—
Screen 2	Jun/Jul 1994	X	—	—	—	—	—	—	—	2.6	—	NA
	Nov/Dec 1994		—	0.6	—	—	—	—	—	1.1	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	5.5(TB)	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	4.8	1.9(B) Naphthalene	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	4.4	8.0(EP) Carbon Disulfide	NA
	Jun/Jul 1997		—	—	—	—	—	—	1.0	1.2	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	0.8(EB)	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	—	—
Screen 3	Jun/Jul 1994	X	—	—	—	—	—	—	—	—	—	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		0.6	0.8	—	—	—	—	—	1.6(TB)	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	0.7	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	0.8	—	NA
	Jun/Jul 1997		1.2	0.8	0.6	—	—	—	2.8	1.8	—	21
	Sep/Oct 1997	X	1.2	0.5	—	—	—	—	—	1.6	—	13
	Jan/Feb 1998	X	1.2	—	—	—	—	—	—	2.7	—	6.5

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 4	Jun/Jul 1994	X	—	—	—	—	—	—	—	—	—	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	1.2(TB, EP) Acetone	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	1.0(EP) Hexane	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	4.7(EP) Carbon Disulfide ⁴	—
Screen 5	Jun/Jul 1994	X	—	—	—	—	—	—	—	—	0.7(EP) Carbon Disulfide	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	0.5 Ethylbenzene	NA
											2.2(EP) Carbon Disulfide	
	Aug/Sep 1996		—	—	—	—	—	—	—	—	2.1 Dichloromethane	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	2.1(TB, EP) Acetone	NA
											1.2(EP) Carbon Disulfide	
	Feb/Mar 1997		—	—	—	—	—	—	—	—	1.5(EP) Carbon Disulfide	NA
											2.7(EP) Sulfur Dioxide	
											1.3(EP) Unknown (RT=2.51)	
	Jun/Jul 1997		—	—	—	—	—	—	—	—	4.5(EP) Carbon Disulfide	—
MW-4	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	—	—
Screen 1	Jun/Jul 1994	X	—	—	—	—	—	—	—	—	—	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	2.9(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	7.4
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	—	9.6
Screen 2	Jun/Jul 1994	X	1.9	7.9	—	—	0.8	—	—	3.6	—	NA
	Nov/Dec 1994	X	1.3(EB)	2.5(EB)	—	—	—	—	—	1.7(EB)	1.6(EP) 2-Methylpropane	NA
	Aug/Sep 1996		5.5	19	—	—	0.9	0.7	—	6.7	3.2(B,EP) Acetone	NA
	Oct/Nov 1996		5.3	15	—	—	0.8	0.8	—	5.4	1.8(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		7.9	19	—	—	0.8	0.8	—	7.8	—	NA
	Jun/Jul 1997		4.0	5.7	—	—	—	0.5	—	3.4	—	51
	Sep/Oct 1997	X	4.0	8.0	0.5	0.6	—	0.5	—	3.5(EB)	—	34
	Jan/Feb 1998	X	1.9	2.7	0.6	—	—	—	—	1.8	—	30

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 3	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	3.0(B,EP) Acetone	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	1.5(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 4	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	3.9(B,EP) Acetone	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	1.6(EB, EP) Acetone	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 5	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	--	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	1.9(EB, EP) Acetone	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	7.4(EP) Hexane	--
MW-5	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	1.1	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	--	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	--	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	4.2

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
MW-6	Jun/Jul 1994	X	—	—	—	—	—	—[U]	—	—	—	NA
	Nov/Dec 1994		—	0.7	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	1.3(TB)	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	0.8	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	5.5
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	2.0	1.0	—	—	—	—	—	—
MW-7	Jun/Jul 1994	X	180,190(DUP)	33,34(DUP)	1.5,1.6(DUP)	—	1.0,1.0(DUP)	1.5,1.6(DUP)	3.9[J],3.8[J](DUP)	—	—	NA
	Nov/Dec 1994	X	310,280(DUP)	29,26(DUP)	2.6,2.6(DUP)	—	—	2.3,2.2(DUP)	8.2,8.3(DUP)	—	—	NA
	Aug/Sep 1996		90	39	0.8	—	1.2	1.1	8.8	13(TB)	—	NA
	Oct/Nov 1996		170	27	1.3	—	0.8	2.3	7.7	14	4.3(B,EP) 1,1-Difluoroethane 2.8(B,EP) Acetone	NA
	Feb/Mar 1997		45	27	0.6	—	0.8	0.9	5.1	9.9	—	NA
	Jun/Jul 1997		39	23	0.7	—	0.8	1.0	4.1	11	10(EP) Unknown	285
	Sep/Oct 1997	X	93[J]	22[J]	1.1	—	0.9	1.3	4.7	13	—	550
	Jan/Feb 1998	X	150[J]	24[J]	3.7	—	0.8	2.1[J]	6.4	13	—	720
MW-8	Jun/Jul 1994	X	—	—	—	—	—	—	—	2.3	—	NA
	Nov/Dec 1994	X	5.3	3.5	—	—	—	—	0.9	2.3	—	NA
	Aug/Sep 1996		4.0	4.6	—	—	—	—	—	1.3	—	NA
	Oct/Nov 1996		2.8	2.2	—	—	—	—	0.6	0.6	1.7(TB, EP) Acetone 1.1 Freon 11	NA
	Feb/Mar 1997		1.5	4.5	—	—	—	—	—	1.3	1.9(EP) Carbon Disulfide	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	6.4
	Sep/Oct 1997	X	3.2[J]	3.6[J]	—	—	—	—	—	1.2[J]	1.0 Freon 11[J]	29
	Jan/Feb 1998	X	1.8	1.3[J]	—	—	—	—[U]	—	0.8	0.8 Freon 11	11
MW-9	Jun/Jul 1994	X	—	—	—	—	—	—	—	—	—	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	3.9(EP) Unknown RT=6.21	—

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
MW-10	Jun/Jul 1994	X	0.5	24	0.7	—	—	—	1.8	1.7	1.2 1,1,1-TCA 0.8 Toluene ⁵	NA
	Nov/Dec 1994	X	—	14	1.2	1.5	—	—	0.9	1.9	—	NA
	Aug/Sep 1996		0.7	18	0.5	—	—	—	1.2	1.4(TB)	—	NA
	Oct/Nov 1996		0.6	6.6	1.0	1.9	—	—	0.8	1.1	3.0(B,EP) Acetone 1.1(EP) Unknown scan #350	NA
	Feb/Mar 1997		—	5.2	—	—	—	—	—	0.6	—	NA
	Jun/Jul 1997		—	2.2	—	—	—	—	—	—	—	11
	Sep/Oct 1997	X	—	4.3	1.3	1.2	—	—	—	1.0	—	16
	Jan/Feb 1998	X	—	1.1	2.2	1.6	—	—	—	1.4	—	4.7
MW-11												
Screen 1	Jun/Jul 1994	X	0.6	—	—	—	—	—	—[U]	0.7	—	NA
	Nov/Dec 1994		—	0.6	—	—	—	—	—	5.3	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	2.6(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	7.1 MTBE	NA
											1.8(TB, EP) Acetone	
	Feb/Mar 1997		—	—	—	—	—	—	—	—	—	NA
	Jun/Jul 1997		1.4	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
Screen 2	Jan/Feb 1998	X	—	—	—	—	—	—[U]	—	—	—	—
	Jun/Jul 1994	X	—	—	—	—	—	—[U]	—[U]	0.6	0.7(EP) MTBE 0.5(EP) Carbon Disulfide	NA
	Nov/Dec 1994	X	0.6, 1.0(DUP)	—	—	—	—	—	—	1.9	—	NA
	Aug/Sep 1996		2.4	—	—	—	—	—	—	1.0	—	NA
	Oct/Nov 1996		1.1	—	—	—	—	—	—	1.2	—	NA
	Feb/Mar 1997		1.7	—	—	—	—	—	—	1.0	—	NA
	Jun/Jul 1997		1.2	—	—	—	—	—	—	1.0	—	—
	Sep/Oct 1997	X	0.6	—	—	—	—	—	—	0.6(EB)	—	—
Screen 3	Jan/Feb 1998	X	0.7	—	—	—	—	—[U]	—	0.7	—	—
	Jun/Jul 1994	X	—	—	—	—	—	—	—[U]	0.6	0.5(EP) Carbon Disulfide	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	0.5	—	NA
	Aug/Sep 1996		0.9	—	—	—	—	—	—	1.3	2.9(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	1.4	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	1.1	—	NA
	Jun/Jul 1997		0.7	—	—	—	—	—	—	1.4	—	—
	Sep/Oct 1997	X	0.6	—	—	—	—	—	—	1.3(EB)	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—[U]	—	1.4	—	—

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 4	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	0.5(EP) Carbon Disulfide	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	0.5	2.4(B,EP) Acetone	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	--	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	1.5(EP) 2-Methyl-1-Propene	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	0.5	--	--
Screen 5	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	2.4(B,EP) Acetone	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	1.1(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	44(TB, EP) Carbon Disulfide ⁴	--
MW-12												
Screen 1	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	4.1	--	NA
	Oct/Nov 1996		Not Sampled*	--	--	--	--	--	--	--	--	--
	Feb/Mar 1997		--	--	--	--	--	--	--	5.8	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	0.5	--	--
	Sep/Oct 1997		Not Sampled*	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--[U]	--	0.8	--	--
Screen 2	Jun/Jul 1994	X	0.8,0.7(DUP)	3.0,2.8(DUP)	1.2,1.1(DUP)	--	--	--	--	1.6(TB),1.5(TB)(DUP)	--	NA
	Nov/Dec 1994	X	2.3	1.4	0.6	--	--	--	--	2.1	--	NA
	Aug/Sep 1996		0.9	--	--	--	--	--	--	--	--	NA
	Oct/Nov 1996		1.5	0.6	--	--	--	--	0.5	--	--	NA
	Feb/Mar 1997		1.1	0.5	--	--	--	--	--	--	1.1(B,EB,EP) Acetone	NA
	Jun/Jul 1997		1.0	--	--	--	--	--	--	0.8	--	6.9
	Sep/Oct 1997	X	0.8	--	--	--	--	--	--	0.8(EB)	--	5.8
	Jan/Feb 1998	X	1.1	--	--	--	--	--[U]	--	0.6	--	6.3

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 3	Jun/Jul 1994	X	3.5	—	—	—	—	—	—	1.5(TB)	0.5(EP) Carbon Disulfide	NA
	Nov/Dec 1994	X	7.1	0.6	—	—	—	—	—	5.1	—	NA
	Aug/Sep 1996		4.5	—	—	—	—	—	—	1.3	—	NA
	Oct/Nov 1996		3.8	—	—	—	—	—	—	1.3	1.6(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		6.4	—	—	—	—	—	—	1.4	1.3(B,EP) Acetone	NA
	Jun/Jul 1997		20	—	—	—	—	—	—	1.6	—	5.7
	Sep/Oct 1997	X	14	—	—	—	—	—	—	1.7(EB)	—	6.2
	Jan/Feb 1998	X	23[J]	—	—	—	—	—[U]	—	2.3[J]	—	5.9
Screen 4	Jun/Jul 1994	X	2.7	—	—	—	—	—	—	1.1(TB)	1.1 Dichloromethane ⁵	NA
	Nov/Dec 1994	X	2.1	—	—	—	—	—	—	1.5(TB)	—	NA
	Aug/Sep 1996		6.3	—	—	—	—	—	—	1.4	—	NA
	Oct/Nov 1996		5.1	—	—	—	—	—	—	1.4	2.5(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		4.9	—	—	—	—	—	—	1.3	—	NA
	Jun/Jul 1997		4.9	—	—	—	—	—	—	1.3	—	7.3
	Sep/Oct 1997	X	3.8	—	—	—	—	—	—	1.0(EB)	—	7.6
	Jan/Feb 1998	X	4.0	—	—	—	—	—[U]	—	1.1	—	8.0
Screen 5	Jun/Jul 1994	X	0.7	—	—	—	—	—	—	0.7(TB)	—	NA
	Nov/Dec 1994		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		3.4	—	—	—	—	—	—	0.7	—	NA
	Oct/Nov 1996		1.3	—	—	—	—	—	—	—	1.5(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		1.7	—	—	—	—	—	—	0.5	—	NA
	Jun/Jul 1997		1.9	—	—	—	—	—	—	0.5	—	4.1
	Sep/Oct 1997	X	1.3	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	1.3	—	—	—	—	—[U]	—	—	—	—
MW-13	Jun/Jul 1994	X	15,18(DUP)	71,73(DUP)	0.7,0.8(DUP)	—	8.4,8.9(DUP)	1.6,1.7(DUP)	—	38,37(DUP)	0.7 Toluene ⁵ , (0.9DUP) ⁵	NA
	Nov/Dec 1994	X	69,70(DUP)	66,50(DUP)	0.9,0.9(DUP)	—	5.6,5.4(DUP)	2.4,2.3(DUP)	—,1.3(DUP)	30,31(DUP)	—	NA
	Aug/Sep 1996		21	47	0.6	—	2.5	1.5	0.7	21(TB)	—	NA
	Oct/Nov 1996		27	27	—	—	1.9	1.5	0.6	14	—	NA
	Feb/Mar 1997		18	28	—	—	0.9	1.1	0.6	9.2	—	NA
	Jun/Jul 1997		6.4	24 E	—	—	0.9	0.5	—	11	—	130
	Sep/Oct 1997	X	8.2	19	—	—	1.1	0.5	—	10	—	210
	Jan/Feb 1998	X	12	5.2	0.5	—	—	0.5 (DUP) ³	—	2.9	1.8 Freon 11	99

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
MW-14												
Screen 1	Jun/Jul 1994	X	--	--	0.5	2.0	--	--	--	0.9	--	NA
	Nov/Dec 1994		--	--	--	3.9	--	--	--	0.5	--	NA
	Aug/Sep 1996		--	--	--	2.4	--	--	--	0.6	--	NA
	Oct/Nov 1996		--	--	--	2.9	--	--	--	--	--	NA
	Feb/Mar 1997		--	--	0.7	1.5	--	--	--	0.7	--	NA
	Jun/Jul 1997		--	--	--	2.0	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	1.9	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	2.1	--	--	--	0.5	--	--
Screen 2	Jun/Jul 1994	X	--	--	0.6	0.6	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	0.7	0.6	--	--	--	--	--	NA
	Aug/Sep 1996		--	2.8	1.6	1.4	--	--	--	1.5	--	NA
	Oct/Nov 1996		--	1.5	1.6	1.0	--	--	--	0.9	0.6 1,2,3-Trichlorobenzene 1.1(EB, EP) Acetone	NA
	Feb/Mar 1997		--	0.9	1.9	1.3	--	--	--	0.8	0.8 1,2,3-Trichlorobenzene 1.1(EP) Acetone	NA
	Jun/Jul 1997		--	1.1	1.7	1.5	--	--	--	0.9	0.5 1,2,3-Trichlorobenzene	--
	Sep/Oct 1997	X	--	1.2	1.9	1.6	--	--	--	0.8(EB)	--	--
	Jan/Feb 1998	X	--	--	1.2	0.7	--	--	--	--	8.9(EB,TB,EP) Carbon Disulfide ⁴	9.0
Screen 3	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	--	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	--	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	4.3
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	5.6
Screen 4	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	--	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	--	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 5	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	2.1(B,EP) Acetone	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	1.6(EB,TB,EP) Acetone	NA
											1.3(EP) Carbon Disulfide	
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
MW-15	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	4.6(EB,TB,EP) Carbon Disulfide ⁴	--
	Jun/Jul 1994	X	--	--	--	--	--	--	--	--	--	NA
	Nov/Dec 1994		--	--	--	--	--	--	--	--	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	--	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	2.6(TB, EP) Acetone	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
MW-16	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
	Jun/Jul 1994	X	150	43	1.5	--	4.0	2.3	1.0	58	--	NA
	Nov/Dec 1994	X	200	29	3.0	--	3.0	4.7	2.0	41	--	NA
	Aug/Sep 1996		125	33	1.3	--	2.4	2.2	2.0	40(TB)	--	NA
	Oct/Nov 1996		Not Sampled*									
	Feb/Mar 1997		91	23	1.3	--	1.7	2.6	1.6	29	--	NA
	Jun/Jul 1997		68	25	1.1	--	2.1	1.7	0.6	43	--	615
	Sep/Oct 1997		Not Sampled*									
MW-17	Jan/Feb 1998	X	30[J]	3.5	1.0	--	--	1.3[J]	--	14	--	1230
	Screen 1											
	July 1995		--	--	--	--	--	--	--	--	--	NA
	Dec 1995		--	--	--	--	--	--	--	0.7	--	NA
	Aug/Sep 1996		--	--	--	--	--	--	--	--	4.3(B,EP) Acetone	NA
	Oct/Nov 1996		--	--	--	--	--	--	--	--	1.4(EB, EP) Acetone	NA
	Feb/Mar 1997		--	--	--	--	--	--	--	--	--	NA
	Jun/Jul 1997		--	--	--	--	--	--	--	--	--	--
MW-17	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	2.9	--	--

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 2	July 1995		—	—	—	—	—	—	—	5.6,7.1(DUP)	—	NA
	Dec 1995		—	—	—	—	—	—	—	6.4	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	3.8	4.5(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	6.0	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	5.2	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	4.1	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	6.1	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	5.4	—	—
Screen 3	July 1995		—	—	—	—	—	—	—	4.5	—	NA
	Dec 1995	X	—	—	—	—	—	—	—	9.4	—	NA
	Aug/Sep 1996		2.0	7.9	—	—	—	—	—	7.5	—	NA
	Oct/Nov 1996		3.3	18	0.8	—	—	—	—	8.7	—	NA
	Feb/Mar 1997		5.1	23	1.1	—	—	—	—	6.2	—	NA
	Jun/Jul 1997		1.3	5.9	—	—	—	—	—	8.2	—	12
	Sep/Oct 1997	X	6.6	22	1.4	—	—	—	—	9.2(EB)	—	55
	Jan/Feb 1998	X	3.3	8.7	—	—	—	—	—	6.8	—	25
Screen 4	July 1995		—	1.5	—	—	—	—	—	3.0	2.2(EB,TB,EP) Acetone	NA
	Dec 1995	X	—	8.4	0.5	—	—	—	—	1.2	—	NA
	Aug/Sep 1996		—	9.5	0.5	—	—	—	—	1.1	—	NA
	Oct/Nov 1996		—	8.9	—	—	—	—	—	1.5	—	NA
	Feb/Mar 1997		—	5.8	—	—	—	—	—	0.7	—	NA
	Jun/Jul 1997		—	4.5	—	—	—	—	—	0.6	—	13
	Sep/Oct 1997	X	—	6.8	0.5	—	—	—	—	1.0(EB)	—	16
	Jan/Feb 1998	X	—	7.3	0.6	—	—	—	—	1.2	—	16
Screen 5	July 1995	X	—	1.3	—	—	—	—	—	3.5	—	NA
	Dec 1995	X	—	12	—	—	—	—	—	2.1	—	NA
	Aug/Sep 1996		—	13	0.6	—	—	—	—	1.7	3.4(B,EP) Acetone	NA
	Oct/Nov 1996		—	16	0.7	—	—	—	—	1.7	—	NA
	Feb/Mar 1997		—	14	0.7	—	—	—	—	1.3	—	NA
	Jun/Jul 1997		—	11	0.7	—	—	—	—	1.3	—	12
	Sep/Oct 1997	X	—	8.6	0.6	—	—	—	—	1.4(EB)	—	15
	Jan/Feb 1998	X	—	7.9	—	—	—	—	—	1.5	—	15

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
MW-18												
Screen 1	July 1995		—	—	—	—	—	—	—	—	2.8(EP) Acetone	NA
	Dec 1995		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	1.6	—	NA
	Oct/Nov 1996		Not Sampled*	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	3.0	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	0.8	—	—
	Sep/Oct 1997		Not Sampled*	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998		Not Sampled*	—	—	—	—	—	—	—	—	—
Screen 2	July 1995		—	—	—	—	—	—	—	—	5.0(EB, EP) Acetone	NA
	Dec 1995		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	7.3	—	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	8.2(EB)	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	1.9	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	4.5	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	2.5(EB)	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	3.7	—	—
Screen 3	July 1995		—	—	—	—	—	—	—	1.5	5.5(EB, EP) Acetone	NA
	Dec 1995	X	0.5	—	—	—	—	—	—	4.3	1.9(EB,TB,EP) Acetone	NA
	Aug/Sep 1996		0.7	4.7	2.8	—	—	—	—	5.1	—	NA
	Oct/Nov 1996		0.7	6.4	3.2	—	—	—	—	5.6	—	NA
	Feb/Mar 1997		0.8	6.6	2.9	—	—	—	—	5.1	—	NA
	Jun/Jul 1997		0.6	2.4	1.8	—	—	—	—	4.4	—	—
	Sep/Oct 1997	X	—	3.0	1.9	—	—	—	—	6.2(EB)	—	—
	Jan/Feb 1998	X	—	1.9	1.7	—	—	—	—	6.6	4.1(EP) Unknown RT=4.33	—
Screen 4	July 1995		—	—	—	—	—	—	—	0.9	1.9(EB, EP) Acetone	NA
	Dec 1995	X	1.8	—	0.5	—	—	—	—	0.6	—	NA
	Aug/Sep 1996		2.2	—	0.7	—	—	—	—	0.5	—	NA
	Oct/Nov 1996		2.2	—	0.7	—	—	—	—	0.5	1.4(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		2.2	—	1.5	—	—	—	—	0.6	—	NA
	Jun/Jul 1997		1.9	—	0.7	—	—	—	—	—	—	11
	Sep/Oct 1997	X	2.4	—	0.7	—	—	—	—	—	1.5(EP) Carbon Disulfide	12
	Jan/Feb 1998	X	2.6	—	1.0	—	—	—	—	0.5	—	11

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
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Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 5	July 1995	X	-	-	-	-	-	-	-	0.8	2.4(EB,TB,EP) Acetone	NA
	Dec 1995		-	-	-	-	-	-	-	-	-	NA
	Aug/Sep 1996		-	-	-	-	-	-	-	-	-	NA
	Oct/Nov 1996		-	-	-	-	-	-	-	-	1.6(EB,TB,EP) Acetone	NA
	Feb/Mar 1997		-	-	-	-	-	-	-	-	-	NA
	Jun/Jul 1997		-	-	-	-	-	-	-	-	1.1(EP) Carbon Disulfide	-
	Sep/Oct 1997	X	-	-	-	-	-	-	-	-	-	-
	Jan/Feb 1998	X	-	-	-	-	-	-	-	-	-	-
MW-19												
Screen 1	July 1995		-	-	-	-	-	-	-	-	0.7 Dichloromethane 0.5(EP) Carbon Disulfide 5.1(EP) Acetic Acid	NA
	Dec 1995		-	-	-	-	-	-	-	-	-	NA
	Aug/Sep 1996		-	-	-	-	-	-	-	0.9	3.7(B,EP) Acetone	NA
	Oct/Nov 1996		-	-	-	-	-	-	-	0.6	2.9(EB, EP) Acetone	NA
	Feb/Mar 1997		-	-	-	-	-	-	-	0.8	-	NA
	Jun/Jul 1997		-	-	-	-	-	-	-	2.5	-	-
	Sep/Oct 1997	X	-	-	-	-	-	-	-	1.4(EB)	-	-
	Jan/Feb 1998	X	-	-	-	-	-	-	-	0.8	-	-
Screen 2	July 1995	X	-	-	-	-	-	-	-	-	1.0(EP) Carbon Disulfide 2.0(EP) Acetic Acid	NA
	Dec 1995		-	-	0.7	-	-	-	-	-	-	NA
	Aug/Sep 1996		-	-	0.8	-	-	-	-	-	3.0(B,EP) Acetone	NA
	Oct/Nov 1996		-	-	1.1	-	-	-	-	-	-	NA
	Feb/Mar 1997		-	-	-	-	-	-	-	-	-	NA
	Jun/Jul 1997		-	-	0.6	-	-	-	-	-	-	-
	Sep/Oct 1997	X	-	-	-	-	-	-	-	-	-	-
	Jan/Feb 1998	X	-	0.6	0.9	-	-	-	-	-	-	-
Screen 3	July 1995		-	-	1.3	-	-	-	-	-	-	NA
	Dec 1995	X	-	-	1.8	-	-	-	-	-	-	NA
	Aug/Sep 1996		-	-	3.1	-	-	-	-	-	2.6(B,EP) Acetone	NA
	Oct/Nov 1996		-	-	2.5	-	-	-	-	-	-	NA
	Feb/Mar 1997		-	-	2.1	-	-	-	-	-	-	NA
	Jun/Jul 1997		-	-	2.0	-	-	-	-	-	-	4.1
	Sep/Oct 1997	X	-	-	1.5	-	-	-	-	-	0.6 Toluene	-
	Jan/Feb 1998	X	-	-	2.1	-	-	-	-	-	-	-

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 4	July 1995	X	0.6,0.6(DUP)	2.3,2.4(DUP)	—	—	—	—	—	1.5,1.8(DUP)	1.8(EP) Acetone	NA
	Dec 1995	X	—	1.3	—	—	—	—	—	1.3	—	NA
	Aug/Sep 1996		0.5	1.5	—	—	—	—	—	2.1	—	NA
	Oct/Nov 1996		—	1.5	—	—	—	—	—	1.9	—	NA
	Feb/Mar 1997		—	1.1	0.6	—	—	—	—	1.5	—	NA
	Jun/Jul 1997		—	0.7	—	—	—	—	—	1.3	—	—
	Sep/Oct 1997	X	—	0.7	0.6	—	—	—	—	1.7(EB)	—	4.9
	Jan/Feb 1998	X	—	0.5	0.6	—	—	—	—	1.3	—	—
Screen 5	July 1995		—	—	1.3	—	—	—	—	—	2.2(EB, EP) Acetone	NA
	Dec 1995		—	—	1.5	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	3.0	—	—	—	—	0.6	1.6(B, EP) Unknown scan #940	NA
	Oct/Nov 1996		—	—	2.4	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	1.7	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	1.5	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	2.2	—	—	—	—	0.8(EB)	—	—
	Jan/Feb 1998	X	—	—	1.4	—	—	—	—	—	—	—
MW-20												
Screen 1	July 1995		—	—	—	—	—	—	—	—	2.1(EB, TB, EP) Acetone	NA
	Dec 1995		—	—	—	—	—	—	—	—	1.6(EP) Unknown Scan #1047	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	0.7	3.4(B, EP) Acetone	NA
	Oct/Nov 1996		Not Sampled*	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	1.4	2.4(EB, EP) Acetone	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	0.8	—	5.7
	Sep/Oct 1997		Not Sampled*	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	1.4	—	6.3
Screen 2	July 1995		—	—	—	—	—	—	—	0.5	—	NA
	Dec 1995		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	7.7	4.0(B, EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	4.4	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	3.2	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	3.3	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	5.7(EB)	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	2.7	—	—

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 3	July 1995		—	—	—	—	—	—	—	—	—	NA
	Dec 1995		—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	2.7(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	0.6	2.3(EB, EP) Acetone	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	3.4(EP) Unknown RT=6.2	—
Screen 4	July 1995		—	—	—	—	—	—	—	—	—	NA
	Dec 1995		—	—	—	—	—	—	—	—	2.2(EP) Unknown Scan #1596	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	3.8(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	—	—
Screen 5	July 1995	X	—[U]	—	—	—	—	—	—	—	—	NA
	Dec 1995	X	—	—	—	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	—	—	—	—	—	—	4.8(B,EP) Acetone	NA
	Oct/Nov 1996		—	—	—	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	—	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	—	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	—	—	—	—	—	—	—	—
MW-21												
Screen 1	July 1995	X	—	29[J]	0.5	—	—	—	—	1.9	—	NA
	Dec 1995	X	—	35[J]	—	—	—	—	—	1.7	2.8(EB,TB,EP) Acetone	NA
	Aug/Sep 1996		—	33	0.7	—	—	—	—	1.8	2.3(B,EP) Acetone	NA
	Oct/Nov 1996		Not Sampled*	—	—	—	—	—	—	—	—	—
	Feb/Mar 1997		—	29	—	—	—	—	—	2.2	—	NA
	Jun/Jul 1997		—	20	—	—	—	—	—	1.6	—	19
	Sept/Oct 1997		Not Sampled*	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	16[J]	—	—	—	—[U]	—	1.8	—	14

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Screen 2	July 1995	X	—	—	0.8	—	—	—	—	—	0.6(DUP) 1,1,2,2-Tetrachloroethane	NA
	Dec 1995		—	0.5	2.1	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	—	0.9	—	—	—	—	0.5	—	NA
	Oct/Nov 1996		—	0.6	2.3	—	—	—	—	0.6	1.4(TB, EP) Acetone	NA
	Feb/Mar 1997		—	—	1.1	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	0.7	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	—	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	1.1	—	—	—	—	—	—	—
Screen 3	July 1995		—	—	0.7	—	—	—	—	—	—	NA
	Dec 1995		—	—	1.0	—	—	—	—	—	—	NA
	Aug/Sep 1996		—	0.7	1.5	—	—	—	—	0.5	—	NA
	Oct/Nov 1996		—	0.9	1.6	—	—	—	—	—	1.2(EP) Acetone	NA
	Feb/Mar 1997		—	0.8	1.6	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	1.2	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	0.6	1.3	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	0.5	1.4	—	—	—	—	—	—	—
Screen 4	July 1995		—	—	1.7	—	—	—	—	—	—	NA
	Dec 1995		—	—	1.4	—	—	—	—	—	3.0(EB,TB,EP) Acetone	NA
	Aug/Sep 1996		—	0.8	4.2	—	—	—	—	—	—	NA
	Oct/Nov 1996		—	—	2.5	—	—	—	—	—	1.6(EP) Acetone	NA
	Feb/Mar 1997		—	—	1.8	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	2.8	—	—	—	—	—	—	4.6
	Sep/Oct 1997	X	—	0.6	4.4	—	—	—	—	—	—	5.0
	Jan/Feb 1998	X	—	—	2.4	—	—	—	—	—	—	—
Screen 5	July 1995	X	—	—	0.9	—	—	—	—	—	—	NA
	Dec 1995	X	—	—	1.2	—	—	—	—	—	3.6(EB,TB,EP) Acetone	NA
	Aug/Sep 1996		—	—	4.5	—	—	—	—	0.6	—	NA
	Oct/Nov 1996		—	—	3.1	—	—	—	—	—	—	NA
	Feb/Mar 1997		—	—	3.0	—	—	—	—	—	—	NA
	Jun/Jul 1997		—	—	3.0	—	—	—	—	—	—	—
	Sep/Oct 1997	X	—	—	2.9	—	—	—	—	—	—	—
	Jan/Feb 1998	X	—	—	4.1	—	—	—	—	—	0.6 cis-1,2-Dichloroethene 5.0(TB, EP) Carbon Disulfide ⁴	5.2

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
MW-22¹												
Screen 1	Sep/Oct 1997	X	--	--	2.0	0.7	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	2.3	0.8	--	--	0.5(EB)	--	--	--
Screen 2	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	0.8 Dichloromethane	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 3	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	15
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 4	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 5	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
MW-23¹												
Screen 1	Sep/Oct 1997	X	--	3.1	0.6	0.8	--	--	--	--	--	4.4
	Jan/Feb 1998	X	--	4.2	1.6	1.2	--	--	--	0.9	0.6 1,2,3 Trichlorobenzene	5.2
Screen 2	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	7.6
	Jan/Feb 1998	X	--	--	--	--	--	--	--	0.7	--	6.7
Screen 3	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 4	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 5	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
MW-24¹												
Screen 1	Sep/Oct 1997	X	5.0	5.0	--	--	--	--	0.6	3.1	--	92[J]
	Jan/Feb 1998	X	30(E)	15	0.5	--	0.8	--	0.6	15(EB)	--	330
Screen 2	Sep/Oct 1997	X	13[J]	1.3[J]	--	--	--	--	--	3.8[J]	--	200
	Jan/Feb 1998	X	6.9[J]	0.7	--	--	--	--	--	2.4(EB)	--	110
Screen 3	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 4	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--	--	--	--	--
Screen 5	Sep/Oct 1997	X	--	--	--	--	--	--	--	--	--	--
	Jan/Feb 1998	X	--	--	--	--	--	--[W]	--	--	--	--

TABLE 4-6
SUMMARY OF VOCs AND PERCHLORATE DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
 (Values equal to or above state or Federal MCLs are in bold and shaded)

Sampling Location	Sampling Event	Data Validation	Carbon Tetrachloride	TCE	PCE	1,1-DCA	1,2-DCA	1,1-DCE	Freon 113	Total Trihalomethanes (Primarily Chloroform)	Other Volatile Organic Compounds	Perchlorate
Practical Quantitation Limit			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.0
California Maximum Contaminant Level			0.5	5.0	5.0	5.0	0.5	6.0	1,200	100	150 Freon 11 ^a	18 ²
EPA Region IX Maximum Contaminant Level			5.0	5.0	5.0	NE	5.0	7.0	NE	100	5.0 Dichloromethane ^a	NE

—: Not detected

*: Not sampled, no water over screen

a: Only VOCs for which MCLs have been established are listed

NA: Not analyzed

NE: Not established

(EP): Extraneous peak

(EB): Compound detected in associated equipment blank

(TB): Compound detected in associated trip blank

(B): Compound detected in the laboratory method blank

(E): Estimated concentration; result exceeded calibration range

[J]: Validation qualifier for estimated result

[U]: Validation qualifier for non-detect

[JJ]: Validation qualifier for estimated non-detect

[R]: Validation qualifier for rejected data

1: Wells installed June-August 1997

2: California Department of Health Services Interim Action Level

3: DUP – Results from duplicate analysis; original sample was non-detect, or as noted

4: Suspected by the laboratory to be carry over in analysis

5: Although not detected in associated blanks result may be an artifact of cross-contamination from laboratory activities (based on review of data validation packages)

TABLE 4-7

**LOCATIONS OF PUMPS AND SCREENED INTERVALS OF MUNICIPAL PRODUCTION WELLS
IN JPL AQUIFER LAYERS
JET PROPULSION LABORATORY**

(For additional information regarding production wells, refer to table 3-7)

Municipal Production Well	Elevation Top of Casing (feet above sea level)	Screened Intervals (feet below surface)	Elevation of Screen (feet above sea level)		Depth of Pump Suction (feet below surface)	Elevation of Pump Suction (feet above sea level)	Aquifer Layer	
			Top	Bottom			Pump	Screened Interval
City of Pasadena Arroyo Well	1092.71	20 inch casing: 224-324 26 inch casing: 127-299, 306-331, 367-372, 398-401, 457-489, 498-503, 508-521 538-554, 568-594, 598-624	965.71	468.71	311'-334' 4" AVG 322.6	770.1	2	1,2,3
City of Pasadena Well #52	1056.76	250-360, 360-367, 372-556, 556- 630	806.76	426.76	391'-393' 475" AVG 392.2	664.6	3	2,3
City of Pasadena Ventura	1069.82	20 inch casing: 220-460 26 inch casing: 102-141, 164-218, 241-311, 410-468	967.82	601.82	308' 5"-321' AVG 314.7	755.1	2	1,2,3
City of Pasadena Windsor	1150.3	320-344, 374-384, 426-450, 474-485, 497-585	830.3	565.3	400'-420' AVG 410	740.3	2	1,2,3
Lincoln Avenue Water Well #3	1202.7	463-601	739.7	601.7	597	605.7	3	2,3
Lincoln Avenue Water Well #5	1203.9	390-532, 540-556	813.9	647.9	584	619.9	3	2,3
Las Flores Water Co. Well #2	1160	NA (Gravel Bottom)			350	810.0	2	2,3
Valley Water Co. Well #1	1161.49	155-432	1006.49	729.49	300	861.5	2	1,2,3
Valley Water Co. Well #2	1170.71	165-460	1005.71	710.71	300	870.7	2	1,2,3
Valley Water Co. Well #3	1179.22	192-599	979.22	599.22	300	879.2	2	1,2,3
Valley Water Co. Well #4	1167.7	200-460	957.7	707.7	300	867.7	2	1,2,3
La Canada Irrigation Well #1		12 inch casing: Start @200' 20 inch casing: 200-250, 271-273, 301-306, 331-333, 358-360, 368-376, 381-384, 390-404, 444-448, 452-465, 474-480			350		2	2,3
La Canada Irrigation Well #6	OUT OF SERVICE							
Rubio Canyon Well #4	1140	200-387	940	753	375	765.0	2	1,2
Rubio Canyon Well #7	1140	290-510, 570-700	850	440	365	775.0	2	1,2,3

TABLE 4-8
SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
(EPA Methods 8270 or 525.1^(a) as indicated)

Sample Location	Sample Number	Sample Event	Data Validation	Screened Interval (feet)	Di-n-butylphthalate (8270)	Ethylbenzene (8270)	Di(2-ethylhexyl)phthalate (525.1)	Other SVOCs (8270)	Unknown Semi-Volatile Organic Compounds (8270)
MW-1	MW-3	June 1994	X	70-110	11	9.3(B,EP)	-	-	-
	MW-203	Nov. 1994		70-110	-	-	-	-	8.4(B,EP) Unknown Alkyl Subs. Propanoic Acid 2100(B,EP) Unknown Scan #191
MW-3									
Screen 1	MW-56	June 1994	X	170-180	-	-	-	-	-
	MW-258	Nov. 1994		170-180	10	16(B,EP)	-	-	2900(B,EP) Unknown
Screen 2	MW-54	June 1994	X	250-260	-	-	-	-	-
	MW-254	Nov. 1994		250-260	-	-	-	-	1200(B,EP) Unknown
Screen 2 DUP	MW-258	Nov. 1994		250-260	11	15(B,EP)	-	-	3000(B,EP) Unknown
Screen 3	MW-52	June 1994	X	344-354	-	-	-	-	-
	MW-252	Nov. 1994		344-354	-	12(B,EP)	-	-	2900(B,EP) Unknown
Screen 4	MW-50	June 1994	X	555-565	-	-	-	-	-
	MW-250	Nov. 1994		555-565	-	9(B,EP)	-	-	2300(B,EP) Unknown
Screen 5	MW-48	June 1994	X	650-660	-	-	-	-	12(EP) Unknown Scan #1390
	MW-248	Nov. 1994		650-660	-	16(B,EP)	1.4(EB)	8.9(EP) n-butyl-benzenesulfonamide	2600(B,EP) Unknown
MW-4									
Screen 1	MW-46	June 1994	X	147-157	-	-	-	-	-
	MW-246	Nov. 1994		147-157	-	9(B,EP)	-	-	2100(B,EP) Unknown
Screen 2	MW-44	June 1994	X	237-247	-	-	-	-	-
	MW-244	Nov. 1994	X	237-247	-	- [U]	-	-	-
Screen 3	MW-42	June 1994	X	319-329	-	-	-	-	-
	MW-242	Nov. 1994		319-329	-	14(B,EP)	-	-	3000(B,EP) Unknown
Screen 4	MW-40	June 1994	X	389-399	-	-	-	-	-
	MW-240	Nov. 1994		389-399	-	11(B,EP)	-	-	9(EP) Unknown Scan #252 2600(B,EP) Unknown Scan #191
Screen 5	MW-38	June 1994	X	510-520	-	-	-	-	-
	MW-238	Nov. 1994		510-520	-	13(B,EP)	-	-	2900(B,EP) Unknown
MW-5	MW-9	June 1994	X	85-135	-	- [U]	-	-	6.0(EP) Unknown Scan #432
	MW-209	Nov. 1994		85-135	-	8.3(B,EP)	-	-	11(B,EP) Unknown Alkyl Subs. Propanoic Acid 1900(B,EP) Unknown Scan #188
MW-6	MW-1	June 1994	X	195-245	-	-	-	-	-
	MW-201	Nov. 1994		195-245	-	-	-	-	1800(B,EP) Unknown Scan #190

TABLE 4-8
SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
(EPA Methods 8270 or 525.1^(a) as indicated)

Sample Location	Sample Number	Sample Event	Data Validation	Screened Interval (feet)	Di-n-butylphthalate (8270)	Ethylbenzene (8270)	Di(2-ethylhexyl)phthalate (525.1)	Other SVOCs (8270)	Unknown Semi-Volatile Organic Compounds (8270)
MW-7	MW-23	June 1994	X	225-275	—	—	—	—	—
	MW-223	Nov. 1994	X	225-275	—	— [u]	—	—	—
MW-7 DUP	MW-25	June 1994	X	225-275	—	—	—	—	—
	MW-225	Nov. 1994	X	225-275	—	— [u]	—	—	—
MW-8	MW-11	June 1994	X	155-205	—	— [u]	—	—	7.1(EP) Unknown Scan #433
	MW-211	Nov. 1994	X	155-205	12	— [u]	—	—	—
MW-9	MW-7	June 1994	X	18-68	—	— [u]	—	—	7.9(EP) Unknown Scan #433
	MW-207	Nov. 1994		18-68	11	10(B,EP)	—	—	12(B,EP) Unknown Alkyl Subs. Propanoic Acid 2300(B,EP) Unknown Scan #189
MW-10	MW-14	June 1994	X	105-155	—	—	—	—	—
	MW-214	Nov. 1994	X	105-155	—	— [u]	—	—	—
MW-11									
Screen 1	MW-78	June 1994	X	140-150	—	—	—	—	—
	MW-278	Nov. 1994		140-150	16(EB)	12(B,EP)	—	—	14(B,EP) Unknown Alkyl Subs. Propanoic Acid 2700(B,EP) Unknown Scan #192
Screen 2	MW-76	June 1994	X	250-260	—	—	—	—	—
	MW-276	Nov. 1994	X	250-260	—	— [u]	—	—	—
Screen 3	MW-74	June 1994	X	420-430	—	—	—	—	—
	MW-274	Nov. 1994		420-430	10(EB)	11(B,EP)	—	—	12(B,EP) Unknown Subs. Propanoic Acid 2500(B,EP) Unknown Scan #190
Screen 4	MW-72	June 1994	X	515-525	—	—	—	—	15(EP) Unknown Scan #1226 8.5(EP) Unknown Scan #1237
	MW-272	Nov. 1994		515-525	—	10(B,EP)	—	—	8.3(EP) Unknown Scan #1239 10(B,EP) Unknown Alkyl Subs. Propanoic Acid 2200(B,EP) Unknown Scan #190
Screen 5	MW-70	June 1994	X	630-640	—	—	—	32(EB,EP) 2,4-bis(1,1-dimethylethyl)phenol	—
	MW-270	Nov. 1994		630-640	—	—	—	—	8.6(EP) Unknown Scan #1240 540(B,EP) Subs. Alkyl Hexanedioic Acid Ester 2300(B,EP) Unknown Scan #190

TABLE 4-8
SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
(EPA Methods 8270 or 525.1^(a) as indicated)

Sample Location	Sample Number	Sample Event	Data Validation	Screened Interval (feet)	Di-n-butylphthalate (8270)	Ethylbenzene (8270)	Di(2-ethylhexyl)phthalate (525.1)	Other SVOCs (8270)	Unknown Semi-Volatile Organic Compounds (8270)
MW-12									
Screen 1	MW-68	June 1994	X	135-145	-	-	-	-	-
	MW-268	Nov. 1994		135-145	-	10(B,EP)	-	-	2200(B,EP) Unknown Scan #191 560(B,EP) Unknown Subs. Alkyl Hexanedioic Acid Ester
Screen 2	MW-64	June 1994	X	240-250	-	-	-	12 Benz(a)anthracene 16 Benzo(a)pyrene 28 Benzo(b)fluoranthene 10 Benzo(g,h,i)perylene 11 Benzo(k)fluoranthene 21 Chrysene 39 Fluoranthene 10 Indeno(1,2,3-c,d)pyrene 29 Phenanthrene 33 Pyrene	13(EP) Unknown Polynuclear Aromatic Hydrocarbon
	MW-266	Nov. 1994	X	240-250	-	- [U]	-	-	-
	MW-961-53	Aug. 1996		240-250	NA	NA	NA	NA	NA
Screen 2 DUP	MW-66	June 1994	X	240-250	-	-	-	-	-
	MW-961-54	Aug. 1996		240-250	NA	NA	NA	NA	NA
Screen 3	MW-62	June 1994	X	315-325	-	-	-	-	-
	MW-264	Nov. 1994	X	315-325	-	- [U]	-	-	10(EP) Unknown Scan #1239
Screen 4	MW-60	June 1994	X	430-440	-	-	-	-	-
	MW-262	Nov. 1994	X	430-440	- [U]	- [U]	-	-	-
Screen 5	MW-58	June 1994	X	546-556	-	-	-	-	-
	MW-260	Nov. 1994		656-556	-	12(B,EP)	-	-	2600(B,EP) Unknown
MW-13	MW-17	June 1994	X	180-230	-	-	-	-	36(EP) Unknown Scan #533
	MW-217	Nov. 1994	X	180-230	-	- [U]	-	-	-
MW-13 DUP	MW-19	June 1994	X	180-230	-	-	-	-	-
	MW-219	Nov. 1994	X	180-230	-	- [U]	-	-	-
MW-14									
Screen 1	MW-36	June 1994	X	205-215	-	- [U]	-	-	7.8(EP) Unknown Scan #432
	MW-236	Nov. 1994		205-215	-	27(B,EP)	-	-	17(B,EP) Unknown 17(B,EP) Unknown 2600(B,EP) Unknown 14(B,EP) Unknown Alcohol

TABLE 4-8
SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
(EPA Methods 8270 or 525.1^(a) as indicated)

Sample Location	Sample Number	Sample Event	Data Validation	Screened Interval (feet)	Di-n-butylphthalate (8270)	Ethylbenzene (8270)	Di(2-ethylhexyl)phthalate (525.1)	Other SVOCs (8270)	Unknown Semi-Volatile Organic Compounds (8270)
Screen 2	MW-34	June 1994	X	275-285	-	- [U]	-	-	-
	MW-234	Nov. 1994		275-285	-	12(B,EP)	-	-	2700 (B,EP) Unknown
Screen 3	MW-32	June 1994	X	380-390	-	-	-	-	-
	MW-232	Nov. 1994		380-290	-	14(B,EP)	-	-	3400(B,EP) Unknown
Screen 4	MW-30	June 1994	X	453-463	-	- [U]	-	-	57(EP) Unknown Scan #548 7.4(EP) Unknown Scan #611 7.4(EP) Unknown Scan #669
	MW-230	Nov. 1994		453-453	-	23(B,EP)	-	-	13(B,EP) Unknown 2800(B,EP) Unknown 15(B,EP) Unknown Alcohol
Screen 5	MW-28	June 1994	X	538-548	-	- [U]	-	-	-
	MW-228	Nov. 1994		538-548	-	30(B,EP)	-	-	16(B,EP) Unknown 2900(B,EP) Unknown 17(B,EP) Unknown Alcohol
MW-15	MW-5	June 1994	X	20-70	-	-	-	-	-
	MW-205	Nov. 1994		20-70	15	12(B,EP)	-	-	12(B,EP) Unknown Alkyl Subs. Propanoic Acid 2800(B,EP) Unknown Scan #190
MW-16	MW-21	June 1994	X	230-280	-	-	-	-	-
	MW-221	Nov. 1994	X	230-280	-	- [U]	-	-	-
MW-17									
Screen 1	MW-556-01	July 1995		246-256	-	-	-	-	-
	MW-567-01	Dec. 1995		246-256	-	9.5(B,EP)	1.1	-	-
Screen 2	MW-555-01	July 1995		366-376	-	-	-	9.2(EP) 4,4-Butylidenebis-2-(1,1-dimethylethyl)5-methylphenol	-
	MW-568-01	Dec. 1995		366-376	-	9.8(B,EP)	-	-	-
Screen 2 DUP	MW-555-04	July 1995		366-376	-	8.5(B,EB,EP)	1.2	-	-
Screen 3	MW-554-01	July 1995		466-476	-	-	0.6	-	-
	MW-569-01	Dec. 1995	X	466-476	- [R]	- [U]	- [U]	-	-
Screen 4	MW-553-01	July 1995		578-588	-	-	-	-	-
	MW-570-01	Dec. 1995	X	578-588	- [R]	- [U]	-	-	-
Screen 5	MW-552-01	July 1995	X	723-733	-	-	-	-	-
	MW-571-01	Dec. 1995	X	723-733	- [U]	- [U]	-	-	-

TABLE 4-8
SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
(EPA Methods 8270 or 525.1^(a) as indicated)

Sample Location	Sample Number	Sample Event	Data Validation	Screened Interval (feet)	Di-n-butylphthalate (8270)	Ethylbenzene (8270)	Di(2-ethylhexyl)phthalate (525.1)	Other SVOCs (8270)	Unknown Semi-Volatile Organic Compounds (8270)
MW-18									
Screen 1	MW-551-01	July 1995		266-276	-	-	0.7(EB)	-	-
	MW-566-01	Dec. 1995		266-276	-	9.4(B,EP)	-	-	-
Screen 2	MW-550-01	July 1995		326-336	-	-	2.7	-	-
	MW-565-01	Dec. 1995		326-336	-	13(B,EP)	-	-	-
Screen 3	MW-549-01	July 1995		421-431	-	-	3.0	-	-
	MW-564-01	Dec. 1995	X	421-431	- [U]	- [U]	-	-	-
Screen 4	MW-548-01	July 1995		561-571	-	21(B,EB,EP)	4.2	-	-
	MW-563-01	Dec. 1995	X	561-571	- [U]	- [U]	- [U]	-	-
Screen 5	MW-547-01	July 1995	X	681-691	-	- [U]	1.4(EB)	-	-
	MW-562-01	Dec. 1995		681-691	-	12(B,EP)	-	-	-
MW-19									
Screen 1	MW-541-01	July 1995		240-250	-	-	-	-	-
	MW-581-01	Dec. 1995		240-250	-	-	-	-	-
Screen 2	MW-540-01	July 1995	X	310-320	-	-	-	-	-
	MW-580-01	Dec. 1995		310-320	-	-	0.7	-	11(B,EP) Unknown Scan #92
Screen 3	MW-539-01	July 1995	X	390-400	-	- [U]	-	-	-
	MW-579-01	Dec. 1995	X	390-400	- [U]	-	-	-	8.2(B,EP) Unknown Scan #92
Screen 4	MW-538-01	July 1995	X	442-452	-	- [U]	-	-	-
	MW-578-01	Dec. 1995	X	442-452	- [U]	-	-	-	11(B,EP) Unknown Scan #92
Screen 4 DUP	MW-578-04	Dec. 1995	X	442-452	- [U]	-	-	-	-
Screen 5	MW-537-01	July 1995		492-502	-	11(B,EB,EP)	-	-	8.8(B,EB,EP) Unknown Dimethylbenzene Isomer
	MW-577-01	Dec. 1995		492-502	-	-	-	-	-
MW-20									
Screen 1	MW-546-01	July 1995		228-238	-	-	-	-	-
	MW-576-01	Dec. 1995		228-238	-	-	-	-	-
Screen 2	MW-545-01	July 1995		388-398	-	-	-	-	-
	MW-575-01	Dec. 1995		388-398	-	-	-	-	48(EP) Unknown Scan #1268 21(EP) Unknown Scan #1608 11(EP) Unknown Scan #835
Screen 3	MW-544-01	July 1995		558-568	-	-	-	-	11(EP) Unknown Scan #1311
	MW-574-01	Dec. 1995		558-568	-	14(B,EP)	-	-	-

TABLE 4-8
SUMMARY OF SEMI-VOLATILE ORGANIC COMPOUNDS DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

Concentrations in µg/l
(EPA Methods 8270 or 525.1⁽¹⁾ as indicated)

Sample Location	Sample Number	Sample Event	Data Validation	Screened Interval (feet)	Di-n-butylphthalate (8270)	Ethylbenzene (8270)	Di(2-ethylhexyl)phthalate (525.1)	Other SVOCs (8270)	Unknown Semi-Volatile Organic Compounds (8270)
Screen 4	MW-543-01	July 1995		698-708	-	-	-	-	11(EP) Unknown Scan #1451
	MW-573-01	Dec. 1995		698-708	-	14(B,EP)	-	-	-
Screen 5	MW-542-01	July 1995	X	898-908	-	-	-	-	-
	MW-572-01	Dec. 1995	X	898-908	- [U]	- [U]	-	-	-
MW-21									
Screen 1	MW-561-01	July 1995	X	86-96	-	-	-	-	-
	MW-588-01	Dec. 1995	X	86-96	-	- [U]	-	-	-
Screen 2	MW-560-01	July 1995	X	156-166	-	-	-	-	-
	MW-587-01	Dec. 1995		156-166	-	-	-	-	-
Screen 2 DUP	MW-560-04	July 1995	X	156-166	-	-	0.5	-	-
Screen 3	MW-559-01	July 1995		236-246	-	-	-	-	-
	MW-584-01	Dec. 1995	X	236-246	- [U]	-	-	-	-
Screen 4	MW-558-01	July 1995		306-316	-	9.3(EP)	0.8(EB)	-	-
	MW-583-01	Dec. 1995		306-316	-	-	-	-	-
Screen 5	MW-557-01	July 1995		366-376	-	-	2.1	-	-
	MW-582-01	Dec. 1995	X	366-376	- [U]	-	-	-	-

Notes (1): EPA Method 525.1 includes analyses for hexachlorobenzene, pentachlorophenol, benz(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene and di(2-ethylhexyl)phthalate only.

(2): Analyses completed for the 10 SVOCs detected in MW-12 Screen 2 during the June, 1994 event only.

(B): Indicates constituent also detected in laboratory method blank.

(EB): Indicates constituent also detected in equipment blank collected in the field.

(EP): Indicates constituent is not on method target analyte list and was identified as an extraneous peak by the laboratory.

[U]: Validation qualifier for nondetect.

[UJ]: Validation qualifier for estimated nondetect.

[R]: Validation qualifier for rejected data.

TABLE 4-9

**SUMMARY OF METALS AND CYANIDE DETECTED DURING THE OU-1/OU-3 RI PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM (1994-1995)**

JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
(Values equal to or above state or Federal MCLs are in bold and shaded)

Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-1	June 1994	MW-3	X	Unfiltered	NA	—	0.039	—	—	—	—	—	0.29	0.022	—	—	1.7
	June 1994	MW-4	X	Filtered	NA	—	0.040	—	—	—	—	—	0.29	0.021	NA	—	NA
	Nov 1994	MW-203		Unfiltered	—	—	0.040	—	—	—	—	—	0.31	—	—	—	2.0
	Nov 1994	MW-204		Filtered	—	—	0.038	NA	—	—	—	0.002	0.29	0.025	NA	—	NA
	Aug 1996 ⁽¹⁾	MW-961-01		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	0.8
MW-3																	
Screen 1	June 1994	MW-56	X	Unfiltered	NA	—	0.020	—	—	—	—	—	0.29[μ]	— [μ]	—	—	3.4
	June 1994	MW-57	X	Filtered	NA	—	0.032	—	—	—	—	—	0.29[μ]	0.020(EB)[μ]	NA	—	NA
	Nov 1994	MW-258		Unfiltered	—	—	0.038	—	—	—	—	—	0.34	—	—	—	3.5
	Nov 1994	MW-259		Filtered	—	—	0.037	NA	—	—	—	—	0.33	—	NA	—	NA
	Aug 1996	MW-961-03		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	7.2
Screen 2	June 1994	MW-54	X	Unfiltered	NA	—	0.044	—	—	—	—	— [μ]	0.31[μ]	0.023(EB)[μ]	—	—	0.8
	June 1994	MW-55	X	Filtered	NA	—	0.044	—	—	—	—	— [μ]	0.31[μ]	— [μ]	NA	—	NA
	Nov 1994	MW-256		Unfiltered	—	—	0.043	—	—	—	—	—	0.37	—	—	—	2.9
	Nov 1994	MW-257		Filtered	—	—	0.042	NA	—	—	—	—	0.37	0.037	NA	—	NA
	Aug 1996	MW-961-05		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	1.7
Screen 3	June 1994	MW-52	X	Unfiltered	NA	—	0.024	—	—	—	—	— [μ]	0.24	0.023(EB)	—	—	15.3
	June 1994	MW-53	X	Filtered	NA	—	0.023	—	—	—	—	— [μ]	0.23	—	NA	—	NA
	Nov 1994	MW-252		Unfiltered	—	—	0.023	—	—	—	—	—	0.26	—	—	—	4.2
	Nov 1994	MW-253		Filtered	—	—	0.023	NA	—	—	—	—	0.27	—	NA	—	NA
	Aug 1996	MW-961-07		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	5.2
Screen 4	June 1994	MW-50	X	Unfiltered	NA	—	0.025	—	—	—	—	— [μ]	0.26	—	—	—	6.4
	June 1994	MW-51	X	Filtered	NA	—	0.023	—	—	—	—	— [μ]	0.26	—	NA	—	NA
	Nov 1994	MW-250		Unfiltered	0.081	—	0.027	—	—	—	—	—	0.20	0.025	—	—	3.9
	Nov 1994	MW-251		Filtered	—	—	0.022	NA	—	—	—	—	0.29	—	NA	—	NA
	Aug 1996	MW-961-09		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	4.3
Screen 5	June 1994	MW-48	X	Unfiltered	NA	0.014	—	—	—	—	—	— [μ]	0.10	0.026(EB)	—	—	3.4
	June 1994	MW-49	X	Filtered	NA	0.017	—	—	—	—	—	— [μ]	0.10	—	NA	—	NA
	Nov 1994	MW-248		Unfiltered	0.063(EB)	0.006	—	—	—	—	—	—	0.076	—	—	—	2.0
	Nov 1994	MW-249		Filtered	0.063(EB)	0.006	—	NA	—	—	—	—	0.080	—	NA	—	NA
	Aug 1996	MW-961-11		Unfiltered	0.055	0.011	NA	—	—	NA	NA	—	NA	NA	NA	NA	1.5

TABLE 4-9

**SUMMARY OF METALS AND CYANIDE DETECTED DURING THE OU-1/OU-3 RI PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM (1994-1995)**

JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
(Values equal to or above state or Federal MCLs are in bold and shaded)

Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-4																	
Screen 1	June 1994	MW-46	X	Unfiltered	NA	—	0.043	—	—	—	—	— [u]	0.28	—	—	—	2.5
	June 1994	MW-47	X	Filtered	NA	—	0.043	—	—	—	—	— [u]	0.29	—	NA	—	NA
	Nov 1994	MW-246		Unfiltered	—	—	0.042	—	—	—	—	—	0.33	0.027	—	—	7.2
	Nov 1994	MW-247		Filtered	—	—	0.047	NA	—	—	—	—	0.32	—	NA	—	NA
	Aug 1996	MW-961-13		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	2.6
Screen 2	June 1994	MW-44	X	Unfiltered	NA	—	0.068	—	—	—	—	— [u]	0.48	—	—	—	2.3
	June 1994	MW-45	X	Filtered	NA	—	0.067	—	—	—	—	— [u]	0.48	0.052	NA	—	NA
	Nov 1994	MW-244		Unfiltered	—	—	0.083	—	0.017	—	0.019	—	0.56	—	—	—	5.0
	Nov 1994	MW-245		Filtered	—	—	0.077	NA	—	—	0.036	—	0.53	—	NA	—	NA
	Aug 1996	MW-961-15		Unfiltered	—	—	NA	—	0.023	NA	NA	—	NA	NA	NA	NA	3.8
Screen 3	June 1994	MW-42	X	Unfiltered	NA	—	0.053	—	—	—	—	—	0.28	0.048(EB)	—	—	2.6
	June 1994	MW-43	X	Filtered	NA	—	0.052	—	—	—	—	—	0.28	0.026(EB)	NA	—	NA
	Nov 1994	MW-242		Unfiltered	0.066	—	0.058	—	—	—	—	—	0.32	0.021	—	—	2.2
	Nov 1994	MW-243		Filtered	—	—	0.057	NA	—	—	—	—	0.32	—	NA	—	NA
	Aug 1996	MW-961-19		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	0.6
Screen 4	June 1994	MW-40	X	Unfiltered	NA	—	0.033	—	0.018	—	0.014	—	0.26	0.031(EB)	—	—	3.3
	June 1994	MW-41	X	Filtered	NA	—	0.031	—	—	—	—	—	0.26	0.022(EB)	NA	—	NA
	Nov 1994	MW-240		Unfiltered	—	—	0.032	—	—	—	—	—	0.26	—	—	—	2.1
	Nov 1994	MW-241		Filtered	—	—	0.032	NA	—	—	—	—	0.26	—	NA	—	NA
	Aug 1996	MW-961-21		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	3.0
Screen 5	June 1994	MW-38	X	Unfiltered	NA	—	0.050	—	0.011	—	—	—	0.30	0.027(EB)	—	—	18.0
	June 1994	MW-39	X	Filtered	NA	—	0.045	—	—	—	—	—	0.29	0.033(EB)	NA	—	NA
	Nov 1994	MW-238		Unfiltered	—	—	0.037	—	—	—	—	—	0.28	—	—	—	15.7
	Nov 1994	MW-239		Filtered	—	—	0.037	NA	—	—	—	0.003	0.29	—	NA	—	NA
	Aug 1996	MW-961-23		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	4.5
MW-5																	
Screen 5	June 1994	MW-9	X	Unfiltered	NA	— [u]	0.052	—	—	—	—	—	0.32	0.061	—	—	1.7
	June 1994	MW-10	X	Filtered	NA	—	0.057	—	—	0.015	—	—	0.34	0.025	NA	—	NA
	Nov 1994	MW-209		Unfiltered	—	—	0.054	—	0.011	—	—	—	0.36	—	—	—	1.3
	Nov 1994	MW-210		Filtered	—	—	0.052	NA	—	—	—	—	0.36	—	NA	—	NA
	Aug 1996	MW-961-25		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	2.7

TABLE 4-9

**SUMMARY OF METALS AND CYANIDE DETECTED DURING THE OU-1/OU-3 RI PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM (1994-1995)**

JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
(Values equal to or above state or Federal MCLs are in bold and shaded)

Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-6	June 1994	MW-1	X	Unfiltered	NA	—	0.055	—	0.075	0.012	0.036	—	0.40	0.028	—	—	2.2
	June 1994	MW-2	X	Filtered	NA	—	0.054	—	—	—	0.034	—	0.41	0.034	NA	—	NA
	Nov 1994	MW-201	X	Unfiltered	0.096	—	0.092	—	0.24	—	0.035	—	0.73	0.050	—	—	4.8
	Nov 1994	MW-202		Filtered	—	—	0.086	NA	—	—	0.019	—	0.72	—	NA	—	NA
	Aug 1996	MW-961-27		Unfiltered	—	—	NA	—	0.050	NA	NA	—	NA	NA	NA	NA	4.5
MW-7	June 1994	MW-23	X	Unfiltered	NA	—	0.049	—	—	—	—	—	0.34[u]	—[w]	—	—	4.6
	June 1994	MW-24	X	Filtered	NA	—	0.048	—	—	—	—	—	0.34[u]	—[w]	NA	—	NA
	Nov 1994	MW-223	X	Unfiltered	—	—	0.048	—	0.012	—	—	—	0.34	—	—	—	3.2
	Nov 1994	MW-224		Filtered	—	—	0.047	NA	0.011	—	—	—	0.33	—	NA	—	NA
	Aug 1996	MW-961-29		Unfiltered	—	—	NA	0.007	0.013	NA	NA	—	NA	NA	NA	NA	4.8
MW-7 DUP	June 1994	MW-25	X	Unfiltered	NA	—	0.048	—	—	—	—	—	0.34[u]	—[w]	—	—	4.6
	June 1994	MW-26	X	Filtered	NA	—	0.049	—	—	—	—	—	0.34[u]	—[w]	NA	—	NA
	Nov 1994	MW-225		Unfiltered	—	—	0.055	—	0.013	—	—	—	0.34	0.038	—	—	3.2
	Nov 1994	MW-226		Filtered	—	—	0.048	NA	0.012	—	—	—	0.33	—	NA	—	NA
	Aug 1996	MW-961-31		Unfiltered	—	—	NA	0.011	0.012	NA	NA	—	NA	NA	NA	NA	4.8
MW-8	June 1994	MW-11	X	Unfiltered	NA	—[w]	0.039	—	—	0.024	—	—	0.26	0.029	—	—	4.2
	June 1994	MW-12	X	Filtered	NA	—	0.039	—	—	—	—	0.002	0.27	0.028	NA	—	NA
	Nov 1994	MW-211		Unfiltered	0.13	—	0.040	—	—	—	—	—	0.27	—	—	—	4.3
	Nov 1994	MW-212		Filtered	—	—	0.035	NA	—	—	—	—	0.26	—	NA	—	NA
	Aug 1996	MW-961-33		Unfiltered	0.160	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	4.0
MW-9	June 1994	MW-7	X	Unfiltered	NA	—	0.058	—	—	—	—	—	0.33	0.030	—	—	5.6
	June 1994	MW-8	X	Filtered	NA	—	0.055	—	—	—	—	—	0.32	0.022	NA	—	NA
	Nov 1994	MW-207		Unfiltered	0.16	—	0.092	—	—	—	—	—	0.55	—	—	—	3.9
	Nov 1994	MW-208		Filtered	—	—	0.094	NA	—	—	—	—	0.56	—	NA	—	NA
	Aug 1996	MW-961-35		Unfiltered	0.110	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	2.1
MW-10	June 1994	MW-14	X	Unfiltered	NA	—	0.096	—	0.012	—	—	—[w]	0.61[u]	—[w]	—	—	3.8
	June 1994	MW-15	X	Filtered	NA	—	0.095	—	—	—	—	—	0.61[u]	—[w]	NA	—	NA
	Nov 1994	MW-214		Unfiltered	0.11	—	0.14	—	0.017	—	0.012	—	0.95	—	—	—	4.0
	Nov 1994	MW-215		Filtered	—	—	0.13	NA	0.010	—	—	—	0.89	—	NA	—	NA
	Aug 1996	MW-961-37		Unfiltered	0.190	—	NA	0.010	0.011	NA	NA	—	NA	NA	NA	NA	4.5

TABLE 4-9

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JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
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Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-11																	
Screen 1	June 1994	MW-78	X	Unfiltered	NA	—	0.038	—	0.021	—	0.022	—	0.49	0.021(EB)	0.006	—	6.8
	June 1994	MW-79	X	Filtered	NA	—	0.038	—	—	—	—	0.002	0.50	—	NA	—	NA
	Nov 1994	MW-278		Unfiltered	—	—	0.033	—	—	—	0.012	—	0.49	—	—	—	1.9
	Nov 1994	MW-279		Filtered	—	—	0.030	NA	—	—	—	—	0.48	—	NA	—	NA
	Aug 1996	MW-961-41		Unfiltered	0.052	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	4.0
Screen 2	June 1994	MW-76	X	Unfiltered	NA	—	0.047	—	—	—	—	—	0.40	0.030(EB)	—	—	11.4
	June 1994	MW-77	X	Filtered	NA	—	0.037	—	—	—	—	—	0.41	—	NA	—	NA
	Nov 1994	MW-276		Unfiltered	—	—	0.048	—	—	—	—	—	0.47	—	—	—	0.5
	Nov 1994	MW-277		Filtered	—	—	0.043	NA	—	—	—	—	0.47	—	NA	—	NA
	Aug 1996	MW-961-43		Unfiltered	0.055	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	4.5
Screen 3	June 1994	MW-74	X	Unfiltered	NA	—	0.041	—	—	—	0.011	0.013	0.39	0.023(EB)	—	—	2.9
	June 1994	MW-75	X	Filtered	NA	—	0.047	—	—	—	—	0.025	0.40	—	NA	—	NA
	Nov 1994	MW-274		Unfiltered	—	—	0.15	—	—	—	—	—	0.43	0.020	—	—	3.2
	Nov 1994	MW-275		Filtered	—	—	0.048	NA	—	—	—	—	0.44	—	NA	—	NA
	Aug 1996	MW-961-45		Unfiltered	0.077	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	0.5
Screen 4	June 1994	MW-72	X	Unfiltered	NA	— [u]	0.031	—	—	—	—	— [u]	0.40[u]	0.024	—	—	4.4
	June 1994	MW-73	X	Filtered	NA	— [u]	0.030	—	—	—	—	— [u]	0.41[u]	—	NA	—	NA
	Nov 1994	MW-272		Unfiltered	—	—	0.029	—	—	—	—	—	0.40	—	—	—	2.7
	Nov 1994	MW-273		Filtered	—	—	0.028	NA	—	—	—	—	0.39	—	NA	—	NA
	Aug 1996	MW-961-48		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	3.9
Screen 5	June 1994	MW-70	X	Unfiltered	NA	— [u]	0.026	—	0.012	—	0.010	— [u]	0.26[u]	0.041	0.006	—	2.5
	June 1994	MW-71	X	Filtered	NA	—	0.027	—	—	—	—	— [u]	0.26[u]	0.028	NA	—	NA
	Nov 1994	MW-270		Unfiltered	—	—	0.097	—	—	—	—	—	0.26	0.053	—	—	2.6
	Nov 1994	MW-271		Filtered	—	—	0.028	NA	—	—	—	0.002	0.26	—	NA	—	NA
	Aug 1996	MW-961-49		Unfiltered	0.055	0.007	NA	—	—	NA	NA	—	NA	NA	NA	NA	0.6

TABLE 4-9

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MW-12																	
Screen 1	June 1994	MW-68	X	Unfiltered	NA	-	0.048	-	-	-	-	- [w]	0.34[u]	-	-	-	1.9
	June 1994	MW-69	X	Filtered	NA	-	0.048	-	-	0.010(EB)	-	- [w]	0.34[u]	-	NA	-	NA
	Nov 1994	MW-268		Unfiltered	-	-	0.046	-	-	-	-	-	0.36	-	-	-	4.4
	Nov 1994	MW-269		Filtered	-	-	0.046	NA	-	-	-	0.020	0.35	-	NA	-	NA
	Aug 1996	MW-961-51		Unfiltered	1.10	-	NA	-	-	NA	NA	0.004	NA	NA	NA	NA	50.4
Screen 2	June 1994	MW-64	X	Unfiltered	NA	-	0.042	-	0.016	-	-	-	0.39[u]	-	-	-	12.3
	June 1994	MW-65	X	Filtered	NA	-	0.042	-	-	-	-	- [w]	0.39[u]	-	NA	-	NA
	Nov 1994	MW-266		Unfiltered	-	-	0.027	-	-	-	-	-	0.35	-	-	-	13.8
	Nov 1994	MW-267		Filtered	-	-	0.027	NA	-	-	-	-	0.37	-	NA	-	NA
	Aug 1996	MW-961-53		Unfiltered	-	-	NA	-	-	NA	NA	0.024	NA	NA	NA	NA	4.0
Screen 2 DUP	June 1994	MW-66	X	Unfiltered	NA	-	0.044	-	-	-	-	- [w]	0.44[u]	-	-	-	12.3
	June 1994	MW-67	X	Filtered	NA	-	0.40	-	0.014	-	-	- [w]	0.38[u]	-	NA	-	NA
Screen 3	June 1994	MW-62	X	Unfiltered	NA	-	0.034	-	-	-	-	-	0.37[u]	0.028	-	-	16.3
	June 1994	MW-63	X	Filtered	NA	-	0.031	-	-	-	-	- [w]	0.38[u]	-	NA	-	NA
	Nov 1994	MW-264		Unfiltered	-	-	0.033	-	-	-	-	-	0.43	0.024	-	-	15.2
	Nov 1994	MW-265		Filtered	-	-	0.029	NA	-	-	-	0.005	0.41	-	NA	-	NA
	Aug 1996	MW-961-55		Unfiltered	-	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	2.5
Screen 4	June 1994	MW-60	X	Unfiltered	NA	-	0.050	-	-	-	-	-	0.40[u]	0.022(EB)	-	-	3.2
	June 1994	MW-61	X	Filtered	NA	-	0.053	-	-	-	-	-	0.42[u]	0.029(EB)	NA	-	NA
	Nov 1994	MW-262		Unfiltered	-	-	0.049	-	-	-	-	-	0.42	-	-	-	2.8
	Nov 1994	MW-263		Filtered	-	-	0.049	NA	-	-	-	-	0.43	-	NA	-	NA
	Aug 1996	MW-961-57		Unfiltered	0.086	-	NA	-	-	NA	NA	0.005	NA	NA	NA	NA	1.8
Screen 5	June 1994	MW-58	X	Unfiltered	NA	-	0.030	-	-	0.020(EB)	0.011	-	0.33[u]	0.020(EB)	-	-	3.3
	June 1994	MW-59	X	Filtered	NA	-	0.030	-	-	-	-	-	0.34[u]	0.031(EB)	NA	-	NA
	Nov 1994	MW-260	X	Unfiltered	-	-[R]	0.025	-	-	-	-	- [R]	0.18	-	-	-	3.9
	Nov 1994	MW-261		Filtered	-	-	0.023	NA	-	-	-	-	0.18	-	NA	-	NA
	Aug 1996	MW-961-59		Unfiltered	0.060	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	2.0
MW-13																	
MW-13	June 1994	MW-17	X	Unfiltered	NA	-	0.063	-	0.062	-	-	- [w]	0.51[u]	- [w]	-	-	4.7
	June 1994	MW-18	X	Filtered	NA	-	0.061	-	0.054	-	-	-	0.52[u]	- [w]	NA	-	NA
	Nov 1994	MW-217	X	Unfiltered	0.14	-	0.043	0.019	0.033	-	-	-	0.40	-	-	-	3.6
	Nov 1994	MW-218	X	Filtered	-	-	0.042	NA	0.024	-	-	-	0.39	-	NA	-	NA
	Aug 1996	MW-961-61		Unfiltered	0.092	-	NA	0.047	0.046	NA	NA	-	NA	NA	NA	NA	4.1

TABLE 4-9

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Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-13 dup	June 1994	MW-19	X	Unfiltered	NA	-	0.063	-	0.061	-	-	-	0.51[j]	- [w]	-	-	4.7
	June 1994	MW-20	X	Filtered	NA	-	0.058	-	0.054	-	-	-	0.49[j]	- [w]	NA	-	NA
	Nov 1994	MW-219	X	Unfiltered	0.10	-	0.043	0.026	0.026	-	-	-	0.40	-	-	-	3.6
	Nov 1994	MW-220		Filtered	-	-	0.043	NA	0.024	-	-	-	0.40	-	NA	-	NA
MW-14																	
Screen 1	June 1994	MW-36	X	Unfiltered	NA	-	0.15	-	-	0.017	-	-	1.2	0.029	-	-	3.4
	June 1994	MW-37	X	Filtered	NA	-	0.15	-	-	0.012(EB)	-	-	1.2	0.024(EB)	NA	-	NA
	Nov 1994	MW-236		Unfiltered	-	-	0.15	-	-	-	-	-	1.2	-	-	-	6.9
	Nov 1994	MW-237		Filtered	-	-	0.15	NA	-	-	-	-	1.2	-	NA	-	NA
	Aug 1996	MW-961-63		Unfiltered	-	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	3.3
Screen 2	June 1994	MW-34	X	Unfiltered	NA	-	0.089	-	0.012	-	-	- [w]	0.93	0.037(EB)	-	-	7.9
	June 1994	MW-35	X	Filtered	NA	-	0.091	-	-	-	-	- [w]	0.96	0.047(EB)	NA	-	NA
	Nov 1994	MW-234		Unfiltered	-	-	0.095	-	-	-	-	-	1.1	-	-	-	4.2
	Nov 1994	MW-235		Filtered	-	-	0.092	NA	-	-	-	-	1.1	-	NA	-	NA
	Aug 1996	MW-961-65		Unfiltered	-	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	4.4
Screen 3	June 1994	MW-32	X	Unfiltered	NA	-	0.047	-	-	-	-	- [w]	0.38	0.031(EB)	-	-	4.4
	June 1994	MW-33	X	Filtered	NA	-	0.040	-	0.012	-	-	- [w]	0.38	0.088(EB)	NA	-	NA
	Nov 1994	MW-232		Unfiltered	-	-	0.060	-	-	-	-	-	0.46	-	-	-	2.8
	Nov 1994	MW-233		Filtered	-	-	0.060	NA	-	-	-	-	0.46	0.071(EB)	NA	-	NA
	Aug 1996	MW-961-67		Unfiltered	-	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	1.7
Screen 4	June 1994	MW-30	X	Unfiltered	NA	-	0.044	-	-	-	-	- [w]	0.27	0.028(EB)	-	-	4.8
	June 1994	MW-31	X	Filtered	NA	-	0.045	-	-	-	-	- [w]	0.27	0.030(EB)	NA	-	NA
	Nov 1994	MW-230		Unfiltered	-	-	0.063	-	-	-	-	-	0.33	-	-	-	13.7
	Nov 1994	MW-231		Filtered	-	-	0.065	NA	-	-	-	-	0.34	-	NA	-	NA
	Aug 1996	MW-961-69		Unfiltered	-	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	3.1
Screen 5	June 1994	MW-28	X	Unfiltered	NA	-	0.034	-	-	-	-	- [w]	0.23	0.030(EB)	-	-	2.0
	June 1994	MW-29	X	Filtered	NA	-	0.028	-	-	-	-	- [w]	0.23	0.028(EB)	NA	-	NA
	Nov 1994	MW-228	X	Unfiltered	-	- [R]	0.032	-	-	-	-	- [R]	0.24	-	-	-	4.1
	Nov 1994	MW-229		Filtered	-	-	0.031	NA	-	-	-	-	0.24	-	NA	-	NA
	Aug 1996	MW-961-71		Unfiltered	-	-	NA	-	-	NA	NA	-	NA	NA	NA	NA	1.5

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Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-15	June 1994	MW-5	X	Unfiltered	NA	—	0.056	—	—	—	—	—	0.33	0.037	—	—	3.9
	June 1994	MW-6	X	Filtered	NA	—	0.051	—	—	—	—	—	0.31	0.21	NA	—	NA
	Nov 1994	MW-205		Unfiltered	—	—	0.085	—	—	—	—	—	0.53	—	—	—	1.4
	Nov 1994	MW-206		Filtered	—	—	0.085	NA	—	—	—	—	0.54	—	NA	—	NA
	Aug 1996	MW-961-73		Unfiltered	—	—	NA	—	—	NA	NA	—	NA	NA	NA	NA	1.3
MW-16	June 1994	MW-21	X	Unfiltered	NA	—	0.073	—	—	—	—	— [w]	0.37[j]	— [w]	—	—	2.3
	June 1994	MW-22	X	Filtered	NA	—	0.077	—	—	—	—	—	0.38[j]	0.022[j]	NA	—	NA
	Nov 1994	MW-221		Unfiltered	—	—	0.056	—	—	—	—	—	0.33	0.031	—	—	2.5
	Nov 1994	MW-222		Filtered	—	—	0.055	NA	—	—	—	—	0.32	—	NA	—	NA
	Aug 1996	MW-961-75		Unfiltered	0.11	—	NA	—	0.018	NA	NA	—	NA	NA	NA	NA	3.4
MW-17																	
Screen 1	July 1995	MW-556-01		Unfiltered	—	—	0.023	NA	—	—	—	—	0.25	—	—	—	0.2
	July 1995	MW-556-02		Filtered	—	—	0.025	NA	—	—	—	—	0.23	—	—	—	0.2
	Dec. 1995	MW-567-01		Unfiltered	—	—	0.025	NA	—	—	—	—	0.27	—	—	—	2.0
	Dec. 1995	MW-567-02		Filtered	—	—	0.024	NA	—	—	—	—	0.26	—	—	—	2.0
	Aug 1996	MW-961-77		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	1.0
Screen 2	July 1995	MW-555-01		Unfiltered	—	—	0.029	NA	—	—	—	—	0.32	0.033	—	—	2.0
	July 1995	MW-555-02		Filtered	0.066	—	0.029	NA	—	—	—	—	0.34	—	—	—	2.0
	Dec. 1995	MW-568-01		Unfiltered	0.13	—	0.034	NA	—	—	—	—	0.31	0.033	—	—	5.0
	Dec. 1995	MW-568-02		Filtered	—	—	0.029	NA	—	—	—	—	0.27	—	—	—	5.0
	Aug 1996	MW-961-78		Unfiltered	0.33	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.5
Screen 2 DUP	July 1995	MW-555-04		Unfiltered	0.089	—	0.028	NA	—	—	—	—	0.32	0.030	—	—	2.0
	July 1995	MW-555-05		Filtered	0.057	—	0.028	NA	—	—	—	—	0.34	0.051	—	—	2.0
Screen 3	July 1995	MW-554-01		Unfiltered	0.19	—	0.027	NA	—	—	—	—	0.23	0.048	—	—	3.5
	July 1995	MW-554-02		Filtered	0.16	—	0.025	NA	—	—	—	—	0.22	—	—	—	3.5
	Dec. 1995	MW-569-01	X	Unfiltered	0.20	—	0.036	NA	—	—	—	—	0.33	—	—	—	11.3
	Dec. 1995	MW-569-02		Filtered	—	—	0.032	NA	—	—	—	—	0.32	—	—	—	11.3
	Aug 1996	MW-961-79		Unfiltered	0.12	—	NA	NA	NA	NA	NA	0.002	NA	NA	NA	NA	4.9
Screen 4	July 1995	MW-553-01		Unfiltered	0.147	—	0.034	NA	—	—	—	—	0.28	0.061(EB)	—	—	4.7
	July 1995	MW-553-02		Filtered	—	—	0.036	NA	—	—	—	—	0.34	0.022(EB)	—	—	4.7
	Dec. 1995	MW-570-01	X	Unfiltered	—	—	0.046	NA	—	—	—	—	0.55	—	—	—	4.5
	Dec. 1995	MW-570-02		Filtered	—	—	0.047	NA	—	—	—	—	0.52	—	—	—	4.5
	Aug 1996	MW-961-80		Unfiltered	0.26	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	2.8

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Screen 5	July 1995	MW-552-01	X	Unfiltered	0.510	—	0.053	NA	—	—	—	—	0.40	0.035(EB)[J]	—	—	5.0
	July 1995	MW-552-02	X	Filtered	0.055	—	0.049	NA	—	—	—	—	0.37	0.024(EB)[J]	—	—	5.0
	Dec. 1995	MW-571-01	X	Unfiltered	0.056	—	0.056	NA	—	—	—	—	0.42	—	—	—	4.9
	Dec. 1995	MW-571-02		Filtered	—	—	0.055	NA	—	—	—	—	0.51	—	—	0.017 Sb 0.012 Se	4.9
	Aug 1996	MW-961-81		Unfiltered	0.21	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	5.0
MW-18																	
Screen 1	July 1995	MW-551-01		Unfiltered	—	—	0.029	NA	—	—	—	—	0.32	—	—	—	1.3
	July 1995	MW-551-02		Filtered	—	—	0.027	NA	—	—	—	—	0.31	0.021(EB)	—	—	1.3
	Dec. 1995	MW-566-01		Unfiltered	—	—	0.023	NA	—	—	—	—	0.27	—	—	—	3.3
	Dec. 1995	MW-566-02		Filtered	—	—	0.023	NA	—	—	—	—	0.28	—	—	—	3.3
	Aug 1996	MW-961-82		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	0.9
Screen 2	July 1995	MW-550-01		Unfiltered	—	—	0.037	NA	—	—	0.018	—	0.31	—	—	—	3.45
	July 1995	MW-550-02		Filtered	—	—	0.034	NA	—	—	—	—	0.39	0.024	—	—	3.45
	Dec. 1995	MW-565-01		Unfiltered	—	—	0.031	NA	—	—	—	—	0.34	—	—	—	2.8
	Dec. 1995	MW-565-02		Filtered	—	—	0.030	NA	—	—	—	—	0.32	—	—	—	2.8
	Aug 1996	MW-961-83		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	3.5
Screen 3	July 1995	MW-549-01		Unfiltered	—	—	0.031	NA	—	—	—	—	0.37	—	—	—	4.57
	July 1995	MW-549-02		Filtered	—	—	0.029	NA	—	—	—	—	0.35	—	—	—	4.57
	Dec. 1995	MW-564-01	X	Unfiltered	—	—	0.029	NA	—	—	—	—	0.39	0.030[J]	—	—	4.1
	Dec. 1995	MW-564-02		Filtered	—	—	0.027	NA	—	—	—	—	0.39	0.030	—	—	4.1
	Aug 1996	MW-961-84		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.2
Screen 4	July 1995	MW-548-01		Unfiltered	—	—	0.033	NA	—	0.044	0.044	—	0.32	0.034(EB)	—	—	1.1
	July 1995	MW-548-02		Filtered	—	—	0.034	NA	—	—	—	—	0.32	—	—	—	1.1
	Dec. 1995	MW-563-01	X	Unfiltered	—	—	0.021	NA	—	—	—	—	0.34	—	—	—	2.1
	Dec. 1995	MW-563-02		Filtered	—	—	0.021	NA	—	—	—	—	0.33	—	—	—	2.1
	Aug 1996	MW-961-86		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	2.0
Screen 5	July 1995	MW-547-01	X	Unfiltered	0.29	—[u]	0.031	NA	—	—	—	—	0.34	—[u]	—	—	5.0
	July 1995	MW-547-02	X	Filtered	—	—[u]	0.028	NA	—	—	—	—	0.32	—[u]	—	0.0003 Hg	5.0
	Dec. 1995	MW-562-01		Unfiltered	0.17	—	0.032	NA	—	—	—	—	0.22	0.065	—	—	6.7
	Dec. 1995	MW-562-02		Filtered	0.05	—	0.032	NA	—	—	—	—	0.22	—	—	—	6.7
	Aug 1996	MW-961-87		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	2.8

TABLE 4-9

**SUMMARY OF METALS AND CYANIDE DETECTED DURING THE OU-1/OU-3 RI PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM (1994-1995)**

JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
(Values equal to or above state or Federal MCLs are in bold and shaded)

Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
MW-19																	
Screen 1	July 1995	MW-541-01		Unfiltered	—	—	0.029	NA	—	—	—	—	0.24	—	—	—	0.6
	July 1995	MW-541-02		Filtered	—	—	0.028	NA	—	—	—	—	0.25	0.032(EB)	—	—	0.6
	Dec. 1995	MW-581-01		Unfiltered	—	—	0.040	NA	—	—	—	—	0.29	—	—	—	3.0
	Dec. 1995	MW-581-02		Filtered	—	—	0.037	NA	—	—	—	—	0.28	—	—	—	3.0
	Aug 1996	MW-961-88		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	5.0
Screen 2	July 1995	MW-540-01	X	Unfiltered	—	—	0.11	NA	—	—	—	—	0.48	0.031	—	—	1.0
	July 1995	MW-540-02		Filtered	—	—	0.11	NA	—	—	—	—	0.46	0.027	—	—	1.0
	Dec. 1995	MW-580-01		Unfiltered	—	—	0.12	NA	—	—	—	—	0.45	—	—	—	5.7
	Dec. 1995	MW-580-02		Filtered	—	—	0.12	NA	—	—	—	—	0.52	0.024	—	—	5.7
	Aug 1996	MW-961-89		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.5
Screen 3	July 1995	MW-539-01		Unfiltered	—	—	0.13	NA	—	—	—	—	0.68	0.032	—	—	4.3
	July 1995	MW-539-02		Filtered	—	—	0.13	NA	—	—	—	—	0.67	0.031	—	—	4.3
	Dec. 1995	MW-579-01	X	Unfiltered	—	—[u]	0.12	NA	—	—	—	0.002	0.61	0.020[j]	—	—	3.8
	Dec. 1995	MW-579-02		Filtered	—	—	0.11	NA	—	—	—	—	0.55	0.032	—	—	3.8
	Aug 1996	MW-961-90		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	3.0
Screen 4	July 1995	MW-538-01	X	Unfiltered	—	—[u]	0.057	NA	—	—	—	—	0.44	0.029	—	—	4.2
	July 1995	MW-538-02		Filtered	—	—	0.056	NA	—	—	—	—	0.47	0.022	—	—	4.2
	Dec. 1995	MW-578-01	X	Unfiltered	—	—[u]	0.059	NA	—	—	—	—	0.48	0.031[j]	—	—	19.7
	Dec. 1995	MW-578-02		Filtered	—	—	0.058	NA	—	—	—	—	0.46	—	—	—	19.7
	Aug 1996	MW-961-91		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.2
Screen 4 DUP	Dec. 1995	MW-578-04	X	Unfiltered	—	—[u]	0.063	NA	—	—	—	—	0.43	0.032[j]	—	—	19.7
	Dec. 1995	MW-578-05		Filtered	—	—	0.057	NA	—	—	—	—	0.46	—	—	—	19.7
Screen 5	July 1995	MW-537-01		Unfiltered	—	—	0.079	NA	—	—	—	—	0.66	0.028(EB)	—	—	4.6
	July 1995	MW-537-02		Filtered	—	—	0.075	NA	—	—	—	—	0.63	0.039(EB)	—	—	4.6
	Dec. 1995	MW-577-01		Unfiltered	—	—	0.089	NA	—	—	—	—	0.78	0.040	—	—	3.2
	Dec. 1995	MW-577-02		Filtered	—	—	0.083	NA	—	—	—	—	0.76	0.52	—	—	3.2
	Aug 1996	MW-961-92		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.9
MW-20																	
Screen 1	July 1995	MW-546-01		Unfiltered	—	—	0.063	NA	—	—	—	—	0.68	0.043(EB)	—	—	2.5
	July 1995	MW-546-02		Filtered	—	—	0.060	NA	—	—	—	—	0.74	0.020(EB)	—	—	2.5
	Dec. 1995	MW-576-01		Unfiltered	—	—	0.042	NA	—	—	—	—	0.72	—	—	—	6.5
	Dec. 1995	MW-576-02		Filtered	—	—	0.041	NA	—	—	—	—	0.66	—	—	—	6.5
	Aug 1996	MW-961-93		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	3.5

TABLE 4-9

**SUMMARY OF METALS AND CYANIDE DETECTED DURING THE OU-1/OU-3 RI PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM (1994-1995)**

JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
(Values equal to or above state or Federal MCLs are in bold and shaded)

Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
Screen 2	July 1995	MW-545-01		Unfiltered	—	—	0.051	NA	—	—	—	—	0.34	—	—	—	2.7
	July 1995	MW-545-02		Filtered	—	—	0.032	NA	—	—	—	—	0.34	0.025(EB)	—	—	2.7
	Dec. 1995	MW-575-01		Unfiltered	—	—	—	NA	—	—	—	—	0.18	—	—	—	3.0
	Dec. 1995	MW-575-02		Filtered	—	—	—	NA	—	—	—	—	0.20	—	—	—	3.0
	Aug 1996	MW-961-94		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	3.9
Screen 3	July 1995	MW-544-01		Unfiltered	0.092	—	0.028	NA	—	—	—	—	0.36	—	—	—	4.7
	July 1995	MW-544-02		Filtered	—	—	0.026	NA	—	—	—	—	—	—	—	—	4.7
	Dec. 1995	MW-574-01		Unfiltered	—	—	0.034	NA	—	—	—	—	0.39	—	—	—	3.0
	Dec. 1995	MW-574-02		Filtered	—	—	0.038	NA	—	—	—	—	0.38	0.049	—	—	3.0
	Aug 1996	MW-961-95		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	1.7
Screen 4	July 1995	MW-543-01		Unfiltered	—	—	—	NA	—	—	—	—	0.10	0.031(EB)	—	—	1.8
	July 1995	MW-543-02		Filtered	—	—	—	NA	—	—	—	—	0.11	0.028(EB)	—	—	1.8
	Dec. 1995	MW-573-01		Unfiltered	—	—	0.022	NA	—	—	—	—	0.09	—	—	0.025 Mo	2.7
	Dec. 1995	MW-573-02		Filtered	—	—	0.022	NA	—	—	—	—	0.09	—	—	0.025 Mo	2.7
	Aug 1996	MW-961-96		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	1.0
Screen 5	July 1995	MW-542-01	X	Unfiltered	0.230[j]	—	0.032	NA	—	—	—	—	0.17	—	—	—	3.2
	July 1995	MW-542-02	X	Filtered	0.082[j]	—	0.030	NA	—	—	—	—	0.16	—	—	—	3.2
	Dec. 1995	MW-572-01	X	Unfiltered	0.100	—	0.037	NA	—	—	—	—	0.21	—	—	—	3.2
	Dec. 1995	MW-572-02		Filtered	—	—	0.036	NA	—	—	—	—	0.19	—	—	—	3.2
	Aug 1996	MW-961-97		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	1.8
MW-21																	
Screen 1	July 1995	MW-561-01	X	Unfiltered	—	—	0.079	NA	—	—	—	0.007[j]	0.88	0.024	—	—	1.7
	July 1995	MW-561-02		Filtered	—	—	0.076	NA	—	—	—	—	0.98	—	—	—	1.7
	Dec. 1995	MW-588-01		Unfiltered	—	—	0.100	NA	—	—	—	—	1.00	—	—	—	2.4
	Dec. 1995	MW-588-02		Filtered	—	—	0.100	NA	—	—	—	—	1.10	—	—	—	2.4
	Aug 1996	MW-961-98		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	0.9
Screen 2	July 1995	MW-560-01	X	Unfiltered	—	—	0.083	NA	—	—	0.014	— [R]	1.30	0.023	—	—	3.5
	July 1995	MW-560-02		Filtered	—	—	0.080	NA	—	—	—	—	1.10	0.024	—	—	3.5
	Dec. 1995	MW-587-01		Unfiltered	0.10	—	0.120	NA	—	—	—	—	1.30	0.020	—	0.0002 Hg	4.8
	Dec. 1995	MW-587-02		Filtered	—	—	0.110	NA	—	—	—	—	1.20	—	—	—	4.8
	Aug 1996	MW-961-99		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	2.1

TABLE 4-9

**SUMMARY OF METALS AND CYANIDE DETECTED DURING THE OU-1/OU-3 RI PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM (1994-1995)**

JET PROPULSION LABORATORY

Concentrations in mg/L unless otherwise noted
(Values equal to or above state or Federal MCLs are in bold and shaded)

Sample Location	Sample Event	Sample Number	Data Validation	Sample Filtered	Al (6010)	As (206.2)	Ba (6010)	Cr ⁶ (7196)	Cr Total (6010)	Cu (6010)	Ni (6010)	Pb (239.2)	Sr (6010)	Zn (6010)	Cyanide (335.3)	Other Metals	Turbidity (NTUs)
Screen 2 DUP	July 1995	MW-560-04	X	Unfiltered	—	—	0.084	NA	—	—	0.012	— [R]	1.20	0.026	—	—	3.5
	July 1995	MW-560-05		Filtered	—	—	0.079	NA	—	—	—	—	1.30	0.027	—	—	3.5
Screen 3	July 1995	MW-559-01		Unfiltered	—	—	0.11	NA	—	—	—	—	0.88	—	—	—	9.5
	July 1995	MW-559-02		Filtered	—	—	0.11	NA	—	—	—	0.002	0.92	—	—	—	9.5
	Dec. 1995	MW-586-01	X	Unfiltered	—	—	0.15	NA	—	—	—	—	0.80	0.27	—	—	12.6
	Dec. 1995	MW-586-02		Filtered	—	—	0.13	NA	—	—	—	—	0.81	—	—	—	12.6
	Aug 1996	MW-961-10		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.6
Screen 4	July 1995	MW-558-01		Unfiltered	—	—	0.091	NA	—	—	—	—	0.67	—	—	—	3.8
	July 1995	MW-558-02		Filtered	—	—	0.089	NA	—	—	—	—	0.66	0.028	—	—	3.8
	Dec. 1995	MW-583-01		Unfiltered	—	—	0.084	NA	—	—	—	—	0.51	—	—	—	4.1
	Dec. 1995	MW-583-02		Filtered	—	—	0.083	NA	—	—	—	—	0.47	—	—	—	4.1
	Aug 1996	MW-961-10		Unfiltered	—	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	2.5
Screen 5	July 1995	MW-557-01		Unfiltered	0.190	—	0.059	NA	—	—	—	—	0.63	—	—	—	11.4
	July 1995	MW-557-02		Filtered	0.068	—	0.054	NA	—	—	—	—	0.63	—	—	—	11.4
	Dec. 1995	MW-582-01	X	Unfiltered	0.230	—	0.079	NA	—	—	—	—	0.74	—	—	—	
	Dec. 1995	MW-582-02		Filtered	—	—	0.072	NA	—	—	—	—	0.72	—	—	—	
	Aug 1996	MW-961-10		Unfiltered	0.012	—	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	4.9
Detection Limits					0.05	0.005	0.02	0.01	0.01	0.01	0.01	0.002	0.01	0.02	0.005	—	—
California Maximum Contaminant Level					1.0	0.05	1.0	—	0.05	—	—	0.015 ⁽²⁾	—	—	—	—	—
EPA Maximum Contaminant Level					0.05-0.2 ⁽²⁾	0.05	2.0	—	0.1	1.0 ⁽²⁾	0.1	0.015 ⁽³⁾	—	5.0 ⁽²⁾	0.2	—	—

Notes

(1): Results of aluminum analysis conducted during the first long-term quarterly sampling event (August, 1996) are included here with previous aluminum results. Results for As, Cr, Cr⁶ and Pb are also included on Table 4-9.

(2): Secondary standard. Maximum value used for shading purposes.

(3): Treatment technique and public notification triggered at Action Level of 0.015 mg/l.

—: Not detected

NA: Not analyzed

EB: Metal also detected in associated equipment blank

[U]: Validation qualifier for nondetect.

[R]: Validation qualifier for rejected data

[J]: Validation qualifier for estimated value

[UJ]: Validation qualifier for estimated non-detect

TABLE 4-10
SUMMARY OF METALS AND CYANIDE RISK SCREENING COMPLETED PRIOR TO THE
LONG-TERM QUARTERLY MONITORING PROGRAM
JET PROPULSION LABORATORY
 (Results from unfiltered samples used)

		METAL															
		Al	As	As* (well avg.)	Ba	Cr(6)	Cr(total) as Cr(3)	Cr(total) as Cr(6)	Cu	Hg	Ni	Pb	Pb* (well avg.)	Sr	Zn	Cyanide	Mo
Maximum	mg/L	0.51	0.014	0.0048	0.4	0.026	0.24	0.24	0.044	0.0002	0.044	0.013	0.0034	1.3	0.065	0.006	0.025
No. of detects	--		2	--		2						3	--				
Freq. Of detects**	--		1.6%	--		1.6%						2.3%	--				
Fed-MCL	mg/L	0.05-0.2	0.05	0.05	2	--	0.1	--	1	0.0002	0.1	0.015	0.015	--	5	0.2	--
Cal-MCL	mg/L	1	0.05	0.05	1	--	0.05	--		0.0002	--	0.05	0.05	--	--	--	--
Reg IX PRG	mg/L	37	4.5E-5	4.5E-5	2.6	0.18	--	0.18	1.4	--	0.73	0.004	0.004	22	11	0.73	0.18
Oral RfD	mg/kg-d	1	3.0E-4	3.0E-4	0.07	0.005	1	0.005	0.037	--	0.02	--	--	0.6	0.3	0.02	0.005
Oral SF	(mg/kg-d)-1	--	1.5	1.5	--	0.42	--	0.42	--	--	--	--	--	--	--	--	--
PEA hazard level	mg/L	15.6	0.0047	0.0047	1.1	0.078	15.6	0.078	0.58	--	0.31	--	--	9.4	4.7	0.31	0.078
PEA risk level	mg/L	--	4.5E-5	4.5E-5	--	1.6E-04	--	1.6E-04	--	--	--	--	--	--	--	--	--
Screening Ratio	Reg IX PRG	0.01	311	107	0.2	0	0	1.3	0.03	0	0.06	3.3	0.9	0.06	0.01	0.01	0.1
	PEA hazard	0.03	3	1	0.4	0	0.0153	3.1	0.08	0	0.1	0	0	0.1	0.01	0.02	0.3
	PEA risk	0	313	107	0	163	0	1502	0	0	0	0	0	0	0	0	0
Include metal in long-term monitoring based on results of the screen?	Reg IX PRG	NO	YES	YES	NO			YES	NO		NO	YES	NO	NO	NO	NO	NO
	PEA	NO	YES	YES	NO	YES	NO	YES	NO		NO			NO	NO	NO	NO

MCL – maximum contaminant level (Fed-MCL from Environmental Law Reporter, 1995, Cal-MCL from Barclay's California Code of Regulations, 1995).

PRG – preliminary remediation goal (USEPA, 1995).

RfD - reference dose (USEPA, 1995).

SF – slope factor (OEHH, 1994).

PEA – preliminary endangerment assessment (Cal-EPA, 1994).

PEA hazard level (mg/L) = RfD / 0.0639.

PEA risk level (mg/L) = $1 \times 10^{-6} / (0.0149 \times \text{SF})$.

Region IX PRG screening ratio = maximum concentration / PRG.

PEA hazard screening ratio = maximum concentration / PEA hazard level.

PEA risk screening ratio = maximum concentration / PEA risk level. Based on 1×10^{-6} acceptable cancer risk level.

If the screening ratio is greater than 1.0, include the metal in monitoring program.

* Maximum concentration based on the average concentration for each well using all samples within each well.

** Based on 128 data points.

TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
MW-1	Jun/Jul 1994	X	-/- ²	-/- ²	-/- ²	-/- ²	1.7
	Nov/Dec 1994		-/-	-/0.002	-/-	-/-	2.0
	Aug/Sep 1996		--	--	--	--	0.8
	Oct/Nov 1996		--	--	--	--	0.5
	Feb/Mar 1997		--	--	--	--	2.5
	Jun/Jul 1997		--	--	--	--	1.92
	Sep/Oct 1997	X	--	--	--	--	0.73
	Jan/Feb 1998	X	--	--	--	--	1.64
MW-3							
Screen 1	Jun/Jul 1994	X	-/-	-/-	-/-	-/-	3.4
	Nov/Dec 1994		-/-	-/-	-/-	-/-	3.5
	Aug/Sep 1996		--	--	--	--	7.2
	Oct/Nov 1996		--	--	--	--	3.1
	Feb/Mar 1997		--	--	--	--	6.1
	Jun/Jul 1997		--	--	--	--	2.61
	Sep/Oct 1997	X	--	--	--	--	2.12
	Jan/Feb 1998	X	-[UJ]	--	--	--	2.87
Screen 2	Jun/Jul 1994	X	-/-	-[UJ]/-[UJ]	-/-	-/-	0.8
	Nov/Dec 1994		-/-	-/-	-/-	-/-	2.9
	Aug/Sep 1996		--	--	--	--	1.7
	Oct/Nov 1996		--	--	--	--	2.7
	Feb/Mar 1997		--	--	--	--	3.8
	Jun/Jul 1997		--	--	--	--	1.13
	Sep/Oct 1997	X	--	--	--	--	2.11
	Jan/Feb 1998	X	-[UJ]	--	--	--	2.25
Screen 3	Jun/Jul 1994	X	-/-	-[UJ]/-[UJ]	-/-	-/-	15.3
	Nov/Dec 1994		-/-	-/-	-/-	-/-	4.2
	Aug/Sep 1996		--	--	--	--	5.2
	Oct/Nov 1996		--	--	--	--	2.7
	Feb/Mar 1997		--	--	--	--	1.7
	Jun/Jul 1997		--	--	--	--	3.41
	Sep/Oct 1997	X	--	--	--	--	4.97
	Jan/Feb 1998	X	--	--	--	--	4.89
Screen 4	Jun/Jul 1994	X	-/-	-[UJ]/-[UJ]	-/-	-/-	6.4
	Nov/Dec 1994		-/-	-/-	-/-	-/-	3.9
	Aug/Sep 1996		--	--	--	--	4.3
	Oct/Nov 1996		--	--	--	--	2.6
	Feb/Mar 1997		--	--	--	--	4.5
	Jun/Jul 1997		--	--	--	--	2.71
	Sep/Oct 1997	X	--	--	--	--	2.45
	Jan/Feb 1998	X	--	--	--	--	2.96
Screen 5	Jun/Jul 1994	X	0.014/0.017	-[UJ]/-[UJ]	-/-	-/-	3.4
	Nov/Dec 1994		0.006/0.006	-/-	-/-	-/NA	2.0
	Aug/Sep 1996		0.011	--	--	--	1.5
	Oct/Nov 1996		0.007	--	--	--	1.9
	Feb/Mar 1997		--	--	--	--	2.5
	Jun/Jul 1997		0.007	--	--	--	0.83
	Sep/Oct 1997	X	0.010	--	--	--	0.96
	Jan/Feb 1998	X	0.009	0.008	--	--	2.28
MW-4							
Screen 1	Jun/Jul 1994	X	-/-	-[UJ]/-[UJ]	-/-	-/-	2.5
	Nov/Dec 1994		-/-	-/-	-/-	-/NA	7.2
	Aug/Sep 1996		--	--	--	--	2.6
	Oct/Nov 1996		--	--	--	--	1.7
	Feb/Mar 1997		--	--	--	--	4.6
	Jun/Jul 1997		--	--	--	--	2.79
	Sep/Oct 1997	X	--	--	--	--	4.76
	Jan/Feb 1998	X	-[R]	--	--	--	3.35

NA: Not analyzed

-/-: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/L

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
Screen 2	Jun/Jul 1994	X	--	--[UJ]/--[UJ]	--	--	2.3
	Nov/Dec 1994		--	--	0.017/	--/NA	5.0
	Aug/Sep 1996		--	--	0.023	--	3.8
	Oct/Nov 1996		--	--	0.014	--	4.2
	Feb/Mar 1997		--	--	0.011	--	4.5
	Jun/Jul 1997		--	--	0.013	--	2.69
	Sep/Oct 1997	X	--	--	0.012	--	3.51
	Jan/Feb 1998	X	--[R]	--	--	--	4.84
Screen 3	Jun/Jul 1994	X	--	--	--	--	2.6
	Nov/Dec 1994		--	--	--	--/NA	2.2
	Aug/Sep 1996		--	--	--	--	0.6
	Oct/Nov 1996		--	--	--	--	1.5
	Feb/Mar 1997		--	--	--	--	2.8
	Jun/Jul 1997		--	--	--	--	1.98
	Sep/Oct 1997	X	--	--	--	--	1.42
	Jan/Feb 1998	X	--[UJ][R]	--	--	--	4.55
Screen 4	Jun/Jul 1994	X	--	--	0.018/	--	3.3
	Nov/Dec 1994		--	--	--	--/NA	2.1
	Aug/Sep 1996		--	--	--	--	3.0
	Oct/Nov 1996		--	--	--	--	1.4
	Feb/Mar 1997		--	--	--	--	2.5
	Jun/Jul 1997		--	--	--	--	4.62
	Sep/Oct 1997	X	--	--	--	--	3.28
	Jan/Feb 1998	X	--[UJ]	--	--	--	4.73
Screen 5	Jun/Jul 1994	X	--	--	0.011/	--	18.0
	Nov/Dec 1994		--	--	--	--/NA	15.7
	Aug/Sep 1996		--	--	--	--	4.5
	Oct/Nov 1996		--	--	--	--	4.1
	Feb/Mar 1997		--	--	--	--	4.4
	Jun/Jul 1997		--	--	--	--	3.98
	Sep/Oct 1997	X	--	--	--	--	3.92
	Jan/Feb 1998	X	--	--	--	--	4.47
MW-5	Jun/Jul 1994	X	--[UJ]/	--	--	--	1.7
	Nov/Dec 1994		--	--	0.011/	--/NA	1.3
	Aug/Sep 1996		--	--	--	--	2.7
	Oct/Nov 1996		--	0.003	--	--	2.7
	Feb/Mar 1997		--	--	--	--	1.5
	Jun/Jul 1997		--	--	--	--	4.50
	Sep/Oct 1997	X	--	--	--	--	1.00
	Jan/Feb 1998	X	--	--	--	--	0.86
MW-6	Jun/Jul 1994	X	--	--	0.075/	--	2.2
	Nov/Dec 1994	X	--	--	0.24/	--/NA	4.8
	Aug/Sep 1996		--	--	0.050	--	4.5
	Oct/Nov 1996		--	--	0.011	--	1.1
	Feb/Mar 1997		--	--	0.014	--	4.3
	Jun/Jul 1997		--	--	0.019	--	2.50
	Sep/Oct 1997	X	--	--	--	--	1.78
	Jan/Feb 1998	X	--	--	--	--	0.42
MW-7	Jun/Jul 1994	X	--	--	--	--	4.6
	Nov/Dec 1994	X	--	--	0.013/0.012	--/NA	3.2
	Aug/Sep 1996		--	--	0.013	0.007	4.8
	Oct/Nov 1996		--	--	0.019	0.019	3.5
	Feb/Mar 1997		--	--	--	0.010	2.2
	Jun/Jul 1997		--	--	--	--	0.98
	Sep/Oct 1997	X	--	--	0.018	--[UJ]	0.77
	Jan/Feb 1998	X	--	--	0.012	--	1.21

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/L

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
MW-8	Jun/Jul 1994	X	--[UJ]/--	--/0.002	--/--	--/--	4.2
	Nov/Dec 1994	X	--/--	--/--	--/--	--/NA	4.3
	Aug/Sep 1996		--	--	--	--	4.0
	Oct/Nov 1996		--	0.003	--	--	4.7
	Feb/Mar 1997		--	--	--	--	3.1
	Jun/Jul 1997		--	0.002	--	--	4.61
	Sep/Oct 1997	X	--	--	--	--	4.20
	Jan/Feb 1998	X	--	--	--	--	3.39
MW-9	Jun/Jul 1994	X	--/--	--/--	--/--	--/--	5.6
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	3.9
	Aug/Sep 1996		--	--	--	--	2.1
	Oct/Nov 1996		--	--	--	--	2.5
	Feb/Mar 1997		--	--	--	--	4.2
	Jun/Jul 1997		--	--	--	--	3.22
	Sep/Oct 1997	X	--	--	--	--	1.03
	Jan/Feb 1998	X	--	--	--	--	2.43
MW-10	Jun/Jul 1994	X	--/--	--[UJ]/--	0.012/--	--/--	3.8
	Nov/Dec 1994		--/--	--/--	0.017/0.010	--/NA	4.0
	Aug/Sep 1996		--	--	0.011	0.010	4.5
	Oct/Nov 1996		--	0.003	0.011	--	4.9
	Feb/Mar 1997		--	--	--	--	2.2
	Jun/Jul 1997		--	--	0.014	--	2.92
	Sep/Oct 1997	X	--	--	--	--	3.23
	Jan/Feb 1998	X	--	--	--	--	2.11
MW-11							
Screen 1	Jun/Jul 1994	X	--/--	--/--	0.021/--	--/--	6.8
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	1.9
	Aug/Sep 1996		--	--	--	--	4.0
	Oct/Nov 1996		--	--	--	--	2.5
	Feb/Mar 1997		--	--	--	--	2.5
	Jun/Jul 1997		--	--	--	--	1.53
	Sep/Oct 1997	X	--[UJ]	--	--	--	4.64
	Jan/Feb 1998	X	--[UJ]	--	--	--	1.03
Screen 2	Jun/Jul 1994	X	--/--	--/--	--/--	--/--	11.4
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	0.5
	Aug/Sep 1996		--	--	--	--	4.5
	Oct/Nov 1996		--	--	--	--	4.7
	Feb/Mar 1997		--	--	--	--	3.1
	Jun/Jul 1997		--	--	--	--	4.67
	Sep/Oct 1997	X	--[UJ]	--	--	--	3.00
	Jan/Feb 1998	X	--[UJ]	--	--	--	2.37
Screen 3	Jun/Jul 1994	X	--/--	0.013/0.025	--/--	--/--	2.9
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	3.2
	Aug/Sep 1996		--	--	--	--	0.5
	Oct/Nov 1996		--	--	--	--	2.3
	Feb/Mar 1997		--	--	--	--	1.7
	Jun/Jul 1997		--	--	--	--	1.88
	Sep/Oct 1997	X	--[UJ]	--	--	--	3.02
	Jan/Feb 1998	X	--	--	--	--	1.39
Screen 4	Jun/Jul 1994	X	--[UJ]/--[UJ]	--[UJ]/--[UJ]	--/--	--/--	4.4
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	2.7
	Aug/Sep 1996		--	--	--	--	3.9
	Oct/Nov 1996		--	--	--	--	3.3
	Feb/Mar 1997		--	0.009	--	--	5.2
	Jun/Jul 1997		--	--	--	--	4.80
	Sep/Oct 1997	X	--[UJ]	--	--	--	4.95
	Jan/Feb 1998	X	--[R]	--	--	--	3.43

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
Screen 5	Jun/Jul 1994	X	--[UJ]/--	--[UJ]/--[UJ]	0.012/--	--/--	2.5
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	2.6
	Aug/Sep 1996		0.007	--	--	--	0.6
	Oct/Nov 1996		0.005	--	--	--	1.9
	Feb/Mar 1997		--	0.002	--	--	1.6
	Jun/Jul 1997		--	--	--	--	0.69
	Sep/Oct 1997	X	--[UJ]	--	--	--	2.55
	Jan/Feb 1998	X	--[R]	--	--	--	1.23
MW-12							
Screen 1	Jun/Jul 1994	X	--/--	--[UJ]/--[UJ]	--/--	--/--	1.9
	Nov/Dec 1994		--/--	--/0.020	--/--	--/NA	4.4
	Aug/Sep 1996		--	0.004	--	--	50.4
	Oct/Nov 1996		Not Sampled*				
	Feb/Mar 1997		--	0.003(EB)	--	--	3.8
	Jun/Jul 1997		--	--	--	--	4.80
	Sep/Oct 1997		Not Sampled*				
	Jan/Feb 1998	X	--	--	--	--	2.63
Screen 2	Jun/Jul 1994	X	--/--	--/[UJ]	0.016/--	--/--	12.3
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	13.8
	Aug/Sep 1996		--	0.024	--	--	4.0
	Oct/Nov 1996		--	--	--	--	4.0
	Feb/Mar 1997		--	--	--	--	2.5
	Jun/Jul 1997		--	--	--	--	3.16
	Sep/Oct 1997	X	--[UJ]	--	--	--	3.37
	Jan/Feb 1998	X	--[UJ]	--	--	--	4.41
Screen 3	Jun/Jul 1994	X	--/--	--/[UJ]	--/--	--/--	16.3
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	15.2
	Aug/Sep 1996		--	--	--	--	2.5
	Oct/Nov 1996		--	--	--	--	3.1
	Feb/Mar 1997		--	--	--	--	5.0
	Jun/Jul 1997		--	--	--	--	4.79
	Sep/Oct 1997	X	--[UJ]	--	--	--	4.18
	Jan/Feb 1998	X	--	--	--	--	2.79
Screen 4	Jun/Jul 1994	X	--/--	--/--	--/--	--/--	3.2
	Nov/Dec 1994		--/--	--/--	--/--	--/NA	2.8
	Aug/Sep 1996		--	0.005	--	--	1.8
	Oct/Nov 1996		--	--	--	--	0.7
	Feb/Mar 1997		--	--	--	--	2.4
	Jun/Jul 1997		--	--	--	--	2.49
	Sep/Oct 1997	X	--[UJ]	--	--	--	1.58
	Jan/Feb 1998	X	--	--	--	--	3.39
Screen 5	Jun/Jul 1994	X	--/--	--/--	--/--	--/--	3.3
	Nov/Dec 1994	X	--[R]/--	--[R]/--	--/--	--/NA	3.9
	Aug/Sep 1996		--	--	--	--	2.0
	Oct/Nov 1996		--	--	--	--	2.0
	Feb/Mar 1997		--	--	--	--	1.5
	Jun/Jul 1997		--	--	--	--	4.97
	Sep/Oct 1997	X	--[UJ]	--	--	--	0.99
	Jan/Feb 1998	X	--[UJ]	--	--	--	2.17

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
MW-13	Jun/Jul 1994	X	--	--[UJ]--	0.062,0.061(DUP) 0.054,0.054(DUP)	--	4.7
	Nov/Dec 1994	X	--	--	0.033,0.026(DUP) 0.024,0.024(DUP)	0.019/NA	3.6
	Aug/Sep 1996		--	--	0.046	0.047	4.1
	Oct/Nov 1996		--	0.005	0.031	0.028	3.0
	Feb/Mar 1997		--	--	0.032	0.035	0.5
	Jun/Jul 1997		--	--	0.038	0.037	1.21
	Sep/Oct 1997	X	--	--	0.050	0.045	2.36
	Jan/Feb 1998	X	--	0.003	0.040	0.036	1.0
MW-14							
Screen 1	Jun/Jul 1994	X	--	--	--	--	3.4
	Nov/Dec 1994		--	--	--	--/NA	6.9
	Aug/Sep 1996		--	--	--	--	3.3
	Oct/Nov 1996		--	--	--	--	4.5
	Feb/Mar 1997		--	--	--	--	4.3
	Jun/Jul 1997		--	--	--	--	2.21
	Sep/Oct 1997	X	--	--	--	--	3.89
	Jan/Feb 1998	X	--	0.004(EB)	--	--	4.96
Screen 2	Jun/Jul 1994	X	--	--[UJ]--[UJ]	0.012/--	--	7.9
	Nov/Dec 1994		--	--	--	--/NA	4.2
	Aug/Sep 1996		--	--	--	--	4.4
	Oct/Nov 1996		--	--	--	--	3.8
	Feb/Mar 1997		--	--	--	--	4.8
	Jun/Jul 1997		--	--	--	--	4.97
	Sep/Oct 1997	X	--	--	--	--	3.22
	Jan/Feb 1998	X	--	0.003(EB)	--	--	4.80
Screen 3	Jun/Jul 1994	X	--	--[UJ]--[UJ]	--	--	4.4
	Nov/Dec 1994		--	--	0.012/--	--/NA	2.8
	Aug/Sep 1996		--	--	--	--	1.7
	Oct/Nov 1996		--	--	--	--	2.0
	Feb/Mar 1997		--	--	--	--	2.5
	Jun/Jul 1997		--	--	--	--	0.70
	Sep/Oct 1997	X	--	--	--	--	2.94
	Jan/Feb 1998	X	--	0.003(EB)	0.026	--	2.14
Screen 4	Jun/Jul 1994	X	--	--[UJ]--[UJ]	--	--	4.8
	Nov/Dec 1994		--	--	--	--/NA	13.7
	Aug/Sep 1996		--	--	--	--	3.1
	Oct/Nov 1996		--	--	--	--	2.5
	Feb/Mar 1997		--	--	--	--	4.1
	Jun/Jul 1997		--	--	--	--	2.31
	Sep/Oct 1997	X	--	--	--	--	1.73
	Jan/Feb 1998	X	--	0.002(EB)	--	--	2.69
Screen 5	Jun/Jul 1994	X	--	--[UJ]--[UJ]	--	--	2.0
	Nov/Dec 1994	X	--[R]--	--[R]--	--	--/NA	4.1
	Aug/Sep 1996		--	--	--	--	1.5
	Oct/Nov 1996		--	--	--	--	4.1
	Feb/Mar 1997		--	0.028	--	--	2.3
	Jun/Jul 1997		--	--	--	--	1.90
	Sep/Oct 1997	X	--	--	--	--	3.80
	Jan/Feb 1998	X	--	--	--	--	4.65

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
MW-15	Jun/Jul 1994	X	-/-	-/-	-/-	-/-	3.9
	Nov/Dec 1994		-/-	-/-	-/-	-/NA	1.4
	Aug/Sep 1996		-	-	-	-	1.3
	Oct/Nov 1996		-	-	-	-	0.5
	Feb/Mar 1997		-	-	-	-	2.6
	Jun/Jul 1997		-	-	-	-	0.21
	Sep/Oct 1997	X	-	-	-	-	0.94
	Jan/Feb 1998	X	-	-	-	-	1.40
MW-16	Jun/Jul 1994	X	-/-	-[UJ]/-	-/-	-/-	2.3
	Nov/Dec 1994		-/-	-/-	-/-	-/NA	2.5
	Aug/Sep 1996		-	-	0.018	-	3.4
	Oct/Nov 1996		Not Sampled*	-	-	-	-
	Feb/Mar 1997		-	-	-	0.007	0.2
	Jun/Jul 1997		-	-	-	-	0.12
	Sep/Oct 1997		Not Sampled*	-	-	-	-
	Jan/Feb 1998	X	-	-	-	-	1.12
MW-17							
Screen 1	July 1995		-/-	-/-	-/-	NA	0.2
	Dec 1995		-/-	-/-	-/-	NA	2.0
	Aug/Sep 1996		-	-	NA	NA	1.0
	Oct/Nov 1996		-	-	-	-	2.9
	Feb/Mar 1997		-	-	-	-	2.0
	Jun/Jul 1997		-	-	-	-	2.23
	Sep/Oct 1997	X	-	-	-	-	1.30
	Jan/Feb 1998	X	-	-	-	-	4.98
Screen 2	July 1995		-/-	-/-	-/-	NA	2.0
	Dec 1995		-/-	-/-	-/-	NA	5.0
	Aug/Sep 1996		-	-	NA	NA	4.5
	Oct/Nov 1996		-	-	-	-	2.5
	Feb/Mar 1997		-	-	-	-	2.7
	Jun/Jul 1997		-	-	-	-	4.49
	Sep/Oct 1997	X	-	-	-	-	1.23
	Jan/Feb 1998	X	-	-	-	-	0.79
Screen 3	July 1995		-/-	-/-	-/-	NA	3.5
	Dec 1995	X	-/-	-/-	-/-	NA	11.3
	Aug/Sep 1996		-	0.002	NA	NA	4.9
	Oct/Nov 1996		-	-	-	-	4.8
	Feb/Mar 1997		-	-	-	-	6.0
	Jun/Jul 1997		-	-	-	-	4.83
	Sep/Oct 1997	X	-	-	-	0.006	2.54
	Jan/Feb 1998	X	-	-	-	-	3.24
Screen 4	July 1995		-/-	-/-	-/-	NA	4.7
	Dec 1995	X	-/-	-/-	-/-	NA	4.5
	Aug/Sep 1996		-	-	NA	NA	2.8
	Oct/Nov 1996		-	-	-	-	2.6
	Feb/Mar 1997		-	-	-	-	5.6
	Jun/Jul 1997		-	-	-	-	4.09
	Sep/Oct 1997	X	-	-	-	-	3.57
	Jan/Feb 1998	X	-	-	-	-	3.94
Screen 5	July 1995	X	-/-	-/-	-/-	NA	5.0
	Dec 1995	X	-/-	-/-	-/-	NA	4.9
	Aug/Sep 1996		-	-	NA	NA	5.0
	Oct/Nov 1996		-	0.005	-	-	5.2
	Feb/Mar 1997		-	0.003	-	-	24.5
	Jun/Jul 1997		-	-	-	-	34.0
	Sep/Oct 1997	X	-	-	-	-	4.83
	Jan/Feb 1998	X	-	-	-	-	4.75

NA: Not analyzed

-/-: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
MW-18							
Screen 1	July 1995		--	--	--	NA	1.3
	Dec 1995		--	--	--	NA	3.1
	Aug/Sep 1996		--	--	NA	NA	0.9
	Oct/Nov 1996		Not Sampled*				
	Feb/Mar 1997		--	--	--	--	1.9
	Jun/Jul 1997		--	--	--	--	0.42
	Sep/Oct 1997		Not Sampled*				
	Jan/Feb 1998		Not Sampled*				
Screen 2	July 1995		--	--	--	NA	3.45
	Dec 1995		--	--	--	NA	2.8
	Aug/Sep 1996		--	--	NA	NA	3.5
	Oct/Nov 1996		--	0.003(EB)	--	--	3.4
	Feb/Mar 1997		--	--	--	--	2.8
	Jun/Jul 1997		--	--	--	--	1.53
	Sep/Oct 1997	X	--	--	--	--	1.43
	Jan/Feb 1998	X	--	--	--	--	3.60
Screen 3	July 1995		--	--	--	NA	4.57
	Dec 1995	X	--	--	--	NA	4.1
	Aug/Sep 1996		--	--	NA	NA	4.2
	Oct/Nov 1996		--	0.002(EB)	--	--	4.0
	Feb/Mar 1997		--	--	0.015	0.007	3.3
	Jun/Jul 1997		--	--	--	--	3.88
	Sep/Oct 1997	X	--	--	--	--	2.05
	Jan/Feb 1998	X	--	--	--	--	0.58
Screen 4	July 1995		--	--	--	NA	1.1
	Dec 1995	X	--	--	--	NA	2.1
	Aug/Sep 1996		--	--	NA	NA	2.0
	Oct/Nov 1996		--	0.003(EB)	--	--	1.9
	Feb/Mar 1997		--	--	--	--	2.8
	Jun/Jul 1997		0.005	--	--	--	3.58
	Sep/Oct 1997	X	--	--	--	--	1.12
	Jan/Feb 1998	X	--	--	--	--	2.23
Screen 5	July 1995	X	--[UJ]/--[UJ]	--	--	NA	5.0
	Dec 1995		--	--	--	NA	6.7
	Aug/Sep 1996		--	--	NA	NA	2.8
	Oct/Nov 1996		--	0.002(EB)	--	--	3.6
	Feb/Mar 1997		--	--	--	--	2.9
	Jun/Jul 1997		--	--	--	--	3.97
	Sep/Oct 1997	X	--	--	--	--	1.65
	Jan/Feb 1998	X	--	--	--	--	1.63
MW-19							
Screen 1	July 1995		--	--	--	NA	0.6
	Dec 1995		--	--	--	NA	3.0
	Aug/Sep 1996		--	--	NA	NA	5.0
	Oct/Nov 1996		--	--	--	--	3.4
	Feb/Mar 1997		--	--	--	--	6.6
	Jun/Jul 1997		--	--	--	--	0.78
	Sep/Oct 1997	X	--	--	--	--	4.63
	Jan/Feb 1998	X	--[UJ]	--	--	--	4.70
Screen 2	July 1995	X	--	--	--	NA	1.0
	Dec 1995		--	--	--	NA	5.7
	Aug/Sep 1996		--	--	NA	NA	4.5
	Oct/Nov 1996		--	--	--	--	3.6
	Feb/Mar 1997		--	--	--	--	21.9
	Jun/Jul 1997		--	--	--	--	2.80
	Sep/Oct 1997	X	--	--	--	--	4.57
	Jan/Feb 1998	X	--[UJ]	--	--	--	4.72

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/L

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
Screen 3	July 1995		--	--	--	NA	4.3
	Dec 1995	X	--[UJ]--	0.002/	--	NA	3.8
	Aug/Sep 1996		--	--	NA	NA	3.0
	Oct/Nov 1996		--	--	--	--	5.0
	Feb/Mar 1997		--	--	--	--	4.9
	Jun/Jul 1997		--	--	--	--	4.88
	Sep/Oct 1997	X	--	--	--	--	2.02
	Jan/Feb 1998	X	--	--	--	--	4.10
Screen 4	July 1995	X	--[UJ]--	--	--	NA	4.2
	Dec 1995	X	--[UJ]--	--	--	NA	19.7
	Aug/Sep 1996		--	--	NA	NA	4.2
	Oct/Nov 1996		--	--	--	--	8.0
	Feb/Mar 1997		--	0.003	--	--	15.8
	Jun/Jul 1997		--	--	--	--	4.88
	Sep/Oct 1997	X	--	--	--	--	4.82
	Jan/Feb 1998	X	--	--	--	--	4.75
Screen 5	July 1995		--	--	--	NA	4.6
	Dec 1995		--	--	--	NA	3.2
	Aug/Sep 1996		--	--	NA	NA	4.9
	Oct/Nov 1996		--	--	--	--	4.6
	Feb/Mar 1997		--	--	--	--	3.8
	Jun/Jul 1997		--	--	--	--	2.15
	Sep/Oct 1997	X	--	--	--	--	4.98
	Jan/Feb 1998	X	--[UJ]	--	--	--	3.98
MW-20							
Screen 1	July 1995		--	--	--	NA	2.5
	Dec 1995		--	--	--	NA	6.5
	Aug/Sep 1996		--	--	NA	NA	3.5
	Oct/Nov 1996		Not Sampled*				
	Feb/Mar 1997		--	--	--	--	2.3
	Jun/Jul 1997		--	--	--	--	0.16
	Sep/Oct 1997		Not Sampled*				
	Jan/Feb 1998	X	--	--	--	--	3.17
Screen 2	July 1995		--	--	--	NA	2.7
	Dec 1995		--	--	--	NA	3.0
	Aug/Sep 1996		--	--	NA	NA	3.9
	Oct/Nov 1996		--	--	--	--	1.1
	Feb/Mar 1997		--	--	--	--	2.1
	Jun/Jul 1997		--	--	--	--	2.54
	Sep/Oct 1997	X	--	--	--	--	3.57
	Jan/Feb 1998	X	--	--	--	--	0.44
Screen 3	July 1995		--	--	--	NA	4.7
	Dec 1995		--	--	--	NA	3.0
	Aug/Sep 1996		--	--	NA	NA	1.7
	Oct/Nov 1996		--	--	--	--	1.6
	Feb/Mar 1997		--	--	--	--	1.9
	Jun/Jul 1997		--	--	--	--	2.14
	Sep/Oct 1997	X	--	--	--	--	4.56
	Jan/Feb 1998	X	--	--	--	--	2.16
Screen 4	July 1995		--	--	--	NA	1.8
	Dec 1995		--	--	--	NA	2.7
	Aug/Sep 1996		--	--	NA	NA	1.0
	Oct/Nov 1996		--	--	--	--	1.3
	Feb/Mar 1997		--	--	--	--	3.3
	Jun/Jul 1997		--	--	--	--	1.29
	Sep/Oct 1997	X	--	--	--	--	1.35
	Jan/Feb 1998	X	--	--	--	--	0.58

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
Screen 5	July 1995	X	-/-	-/-	-/-	NA	3.4
	Dec 1995	X	-/-	-/-	-/-	NA	3.2
	Aug/Sep 1996		-	-	NA	NA	1.8
	Oct/Nov 1996		-	-	-	-	1.3
	Feb/Mar 1997		-	0.004	-	-	1.6
	Jun/Jul 1997		0.006	-	-	-	1.94
	Sep/Oct 1997	X	-	-	-	-	3.50
	Jan/Feb 1998	X	-	-	-	-	0.13
MW-21							
Screen 1	July 1995	X	-/-	0.007[J]/-	-/-	NA	1.7
	Dec 1995		-/-	-/-	-/-	NA	2.4
	Aug/Sep 1996		-	-	NA	NA	0.9
	Oct/Nov 1996		Not Sampled*	-	-	-	-
	Feb/Mar 1997		-	-	-	-	1.1
	Jun/Jul 1997		-	-	-	-	2.76
	Sep/Oct 1997		Not Sampled*	-	-	-	-
	Jan/Feb 1998	X	-	-	-	-	0.79
Screen 2	July 1995	X	-/-	-[R]/-	-/-	NA	3.5
	Dec 1995		-/-	-/-	-/-	NA	6.8
	Aug/Sep 1996		-	-	NA	NA	2.1
	Oct/Nov 1996		-	-	-	-	1.2
	Feb/Mar 1997		-	-	-	-	3.9
	Jun/Jul 1997		-	-	-	-	1.68
	Sep/Oct 1997	X	-	-	-	-	0.75
	Jan/Feb 1998	X	-	-	-	-	0.60
Screen 3	July 1995		-/-	-/0.002	-/-	NA	9.5
	Dec 1995	X	-/-	-/-	-/-	NA	12.6
	Aug/Sep 1996		-	-	NA	NA	4.6
	Oct/Nov 1996		-	-	-	-	4.9
	Feb/Mar 1997		-	0.003	-	-	4.6
	Jun/Jul 1997		-	-	-	-	1.40
	Sep/Oct 1997	X	-[UJ]	-	-	-	3.16
	Jan/Feb 1998	X	-	0.003	-	-	4.79
Screen 4	July 1995		-/-	-/-	-/-	NA	3.8
	Dec 1995		-/-	-/-	-/-	NA	4.1
	Aug/Sep 1996		-	-	NA	NA	2.5
	Oct/Nov 1996		-	-	-	-	3.3
	Feb/Mar 1997		-	0.004	-	-	4.4
	Jun/Jul 1997		-	-	-	-	2.46
	Sep/Oct 1997	X	-	-	-	-	4.51
	Jan/Feb 1998	X	-	-	-	-	1.10
Screen 5	July 1995		-/-	-/-	-/-	NA	11.4
	Dec 1995	X	-/-	-/-	-/-	NA	NA
	Aug/Sep 1996		-	-	NA	NA	4.9
	Oct/Nov 1996		-	-	-	-	5.0
	Feb/Mar 1997		-	-	-	-	28.0
	Jun/Jul 1997		-	-	-	-	26.4
	Sep/Oct 1997	X	-[UJ]	-	-	-	12.19
	Jan/Feb 1998	X	-	-	-	-	4.94
MW-22¹							
Screen 1	Sep/Oct 1997	X	-	-	-	-	33.8
	Jan/Feb 1998	X	-	-	-	-	4.50
Screen 2	Sep/Oct 1997	X	-	-	-	-	4.90
	Jan/Feb 1998	X	-	-	-	-	4.15
Screen 3	Sep/Oct 1997	X	-	-	-	-	2.96
	Jan/Feb 1998	X	-	-	-	-	3.75
Screen 4	Sep/Oct 1997	X	-	-	-	-[UJ]	2.79
	Jan/Feb 1998	X	-	-	-	-	3.69

NA: Not analyzed

-/: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-11
SUMMARY OF METALS OF INTEREST (As, Pb, Cr, CrVI)
DETECTED DURING THE OU-1/OU-3 RI
JET PROPULSION LABORATORY

(Concentrations in mg/L)

Values equal to or above MCLs or action levels are in bold and outlined

Sample Location	Sampling Date	Data Validation	Arsenic	Lead	Total Chromium	Hexavalent Chromium	Field Turbidity (NTUs)
Screen 5	Sep/Oct 1997	X	--	--	--	--[UJ]	4.41
	Jan/Feb 1998	X	--[UJ]	--	--	--	2.81
MW-23¹							
Screen 1	Sep/Oct 1997	X	--	--	--	--	3.44
	Jan/Feb 1998	X	--	--	--	--	4.11
Screen 2	Sep/Oct 1997	X	--	--	--	--	4.92
	Jan/Feb 1998	X	--	--	--	--	4.89
Screen 3	Sep/Oct 1997	X	--	--	--	--	3.04
	Jan/Feb 1998	X	--	--	--	--	4.60
Screen 4	Sep/Oct 1997	X	--	--	--	--	4.88
	Jan/Feb 1998	X	--	--	--	--	4.51
Screen 5	Sep/Oct 1997	X	--	--	--	--	1.76
	Jan/Feb 1998	X	--	--	--	--	1.78
MW-24¹							
Screen 1	Sep/Oct 1997	X	--	--	--	--	1.56
	Jan/Feb 1998	X	--	--	--	--	3.82
Screen 2	Sep/Oct 1997	X	--	--	--	--	4.36
	Jan/Feb 1998	X	--	--	--	--	4.87
Screen 3	Sep/Oct 1997	X	--	--	--	--	4.63
	Jan/Feb 1998	X	0.006	--	--	--	4.71
Screen 4	Sep/Oct 1997	X	--	--	--	--	4.03
	Jan/Feb 1998	X	--	--	--	--	4.87
Screen 5	Sep/Oct 1997	X	--	--	--	--	4.79
	Jan/Feb 1998	X	--	--	--	--	4.76
Practical Quantitation Limit			0.005	0.002	0.01	0.005	
Calif. Maximum Contaminant Level			0.05	(a)	0.05	Not Established	
EPA Maximum Contaminant Level			0.05	(a)	0.10	Not Established	

NA: Not analyzed

--: Not detected

*: Not sampled, no water over screen

[UJ]: Validation qualifier for estimated non-detect

a: Treatment technique and public notification triggered at 0.015 mg/l

1: Wells installed June-August 1997

2: For the first two events, unfiltered/filtered sample data is included

(EB): Constituent also detected in equipment blank

[U]: Validation qualifier for non-detect

[J]: Validation qualifier for estimated result

[R]: Validation qualifier for rejected data

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TABLE 4-12

**SUMMARY OF FLUORIDE ANALYSIS FOR
ON-SITE GROUNDWATER MONITORING WELLS
JET PROPULSION LABORATORY**

(Values above state or Federal MCLs are bold and outlined)
(Concentrations in mg/L)

Well Number	Date Sampled											
	June, 1990	Dec., 1990	June, 1991	Oct., 1991	Apr., 1992	Sep., 1992	Dec., 1992	Mar., 1993	July, 1993	Oct., 1993	June, 1994	Nov., 1994
MW-1	-	-	0.92	0.91	0.60	1.0	-	1.10	1.11	1.11	1.13	1.17
MW-3												
Screen 1	ND	0.45	0.59	0.57	0.60	0.66	0.67	0.64	0.72	0.73	0.74	0.68
Screen 2	1.0	0.58	-	0.67	0.69	0.61	0.66	0.66	0.68	0.66	0.64	0.69
Screen 3	1.6	0.91	-	1.0	0.98	0.90	0.87	0.92	0.88	0.87	0.86	0.86
Screen 4	1.0	0.57	-	0.72	0.70	0.70	0.75	0.69	0.68	0.72	0.66	0.68
Screen 5	2.4	2.9	-	3.3	3.1	3.3	3.1	3.0	3.1	3.0	3.7	3.2
MW-4												
Screen 1	ND	0.29	0.39	0.35	0.42	0.45	0.41	0.40	0.47	0.46	0.36	0.35
Screen 2	ND	0.40	-	0.54	0.47	0.43	0.41	0.47	0.46	0.45	0.47	0.58
Screen 3	0.8	0.40	-	0.52	0.50	0.53	0.54	0.49	0.54	0.54	0.54	0.52
Screen 4	ND	0.40	-	0.55	0.59	0.59	0.55	0.58	0.62	0.54	0.58	0.56
Screen 5	0.9	0.37	-	0.51	0.49	0.50	0.48	0.50	0.46	0.48	0.49	0.45
MW-5	0.7	0.17	0.24	0.24	0.22	0.25	0.24	0.29	0.28	0.26	0.29	0.25
MW-6	ND	0.21	0.32	0.29	0.29	0.29	0.25	0.26	0.30	0.28	0.37	0.65
MW-7	ND	0.40	0.88	0.68	0.80	0.77	0.73	0.67	0.69	0.68	0.69	0.75
MW-8	NA	NA	NA	NA	NA	NA	0.63	0.61	0.62	0.61	0.56	0.63
MW-9	NA	NA	NA	NA	NA	NA	-	-	0.69	0.89	1.10	0.78
MW-10	NA	NA	NA	NA	NA	NA	0.28	0.34	0.34	0.34	0.32	0.30
MW-11												
Screen 1	NA	NA	NA	NA	NA	NA	0.55	0.47	0.46	0.44	0.48	0.35
Screen 2	NA	NA	NA	NA	NA	NA	0.75	0.73	0.73	0.64	0.66	0.48
Screen 3	NA	NA	NA	NA	NA	NA	0.67	0.69	0.69	0.67	0.67	0.60
Screen 4	NA	NA	NA	NA	NA	NA	0.68	0.72	0.66	0.65	0.63	0.54
Screen 5	NA	NA	NA	NA	NA	NA	0.62	0.57	0.45	0.47	0.44	0.40
MW-12												
Screen 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.41	0.35
Screen 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.61	0.47
Screen 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.69	0.75
Screen 4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.55	0.65
Screen 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.66	0.81

TABLE 4-12

**SUMMARY OF FLUORIDE ANALYSIS FOR
ON-SITE GROUNDWATER MONITORING WELLS
JET PROPULSION LABORATORY**

(Values above state or Federal MCLs are bold and outlined)
(Concentrations in mg/L)

Well Number	Date Sampled											
	June, 1990	Dec., 1990	June, 1991	Oct., 1991	Apr., 1992	Sep., 1992	Dec., 1992	Mar., 1993	July, 1993	Oct., 1993	June, 1994	Nov., 1994
MW-13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.43	0.57
MW-14												
Screen 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19	0.18
Screen 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.29	0.25
Screen 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.32	0.25
Screen 4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.48	0.47
Screen 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.48	0.48
MW-15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.06	0.94
MW-16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.48	0.66

Notes:

--: Not Sampled.

NA: Not Applicable. Well not installed at time of sampling.

MCL: Maximum Contaminant Level. State = 1.4 to 2.4 mg/L. Federal = 4.0 mg/L.

TABLE 4-13

**SUMMARY OF FLUORIDE ANALYSIS FOR
OFF-SITE GROUNDWATER MONITORING WELLS
JET PROPULSION LABORATORY**

(Values above state or Federal MCLs are bold and outlined)
(Concentrations in mg/L)

Well Number	Date Sampled	
	July/August, 1995	Dec./Jan., 1995/1996
MW-17		
Screen 1	0.32	0.30
Screen 2	0.49	0.47
Screen 3	0.57	0.53
Screen 4	0.48	0.43
Screen 5	0.47	0.45
MW-18		
Screen 1	0.39	0.35
Screen 2	0.46	0.44
Screen 3	0.49	0.72
Screen 4	0.49	0.54
Screen 5	0.54	0.58
MW-19		
Screen 1	0.32	0.32
Screen 2	0.21	0.19
Screen 3	0.25	0.24
Screen 4	0.39	0.42
Screen 5	0.28	0.30
MW-20		
Screen 1	0.56	0.51
Screen 2	0.62	0.61
Screen 3	0.55	0.53
Screen 4	0.83	0.85
Screen 5	0.87	0.79
MW-21		
Screen 1	0.15	0.17
Screen 2	0.23	0.20
Screen 3	0.22	0.22
Screen 4	0.31	0.35
Screen 5	0.35	0.36

Notes:

MCL: Maximum Contaminant Level. State = 1.4 to 2.4 mg/L. Federal = 4.0 mg/L.

TABLE 4-14

**SUMMARY OF PERFORMANCE EVALUATION (PE) SAMPLE RESULTS
JET PROPULSION LABORATORY**

Volatile Organic Compound	RI Sampling Event			
	September/October, 1997		January/February, 1998	
	PE Sample Concentration (µg/L)	Laboratory Analytical Result (µg/L)	PE Sample Concentration (µg/L)	Laboratory Analytical Result (µg/L)
Trichloroethene (TCE)	7.6	6.0	7.6	6.1
Carbon Tetrachloride	8.3	6.2	8.3	6.4
Tetrachloroethene (PCE)	3.8	3.8	3.8	4.0
1,1,1-Trichloroethane	14.2	14.0	14.2	14.0
1,1,1,2-Tetrachloroethane	11.0	11.0	11.0	12.0
1,1-Dichloroethane	9.7	10.0	9.7	10.0
1,2-Dichloroethane	7.2	8.0	7.2	7.9
p-Dichlorobenzene	11.3	10.0	11.3	9.3
m-Dichlorobenzene	8.5	7.3	8.5	6.9
o-Dichlorobenzene	13.6	11.0	13.6	12.0
Chlorobenzene	10.1	10.0	10.1	11.0
m, p-Xylenes	14.7	15.0	14.7	16.0
Benzene	2.2	2.1	2.2	2.1
Ethylbenzene	6.1	6.4	6.1	6.5
Toluene	8.2	8.2	8.2	8.3
Dichloromethane	20.0	19.0	20.0	20.0
Bromodichloromethane	16.3	16.0	16.3	17.0
Chlorodibromomethane	3.7	3.3	3.7	3.5
Bromoform	12.9	12.0	12.9	14.0
Chloroform	20.4	21.0	20.4	21.0
4-Methyl-2-Pentanone	6.52	ND	6.52	5.5

TABLE 4-15

**SUMMARY OF DATA VALIDATION QUALIFIERS FOR RI GROUNDWATER SAMPLES
JET PROPULSION LABORATORY**

RI Sample Events with Validated Data	VOCs				SVOCs				Metals				Perchlorate			
	Number Validated	J Flag	UJ Flag	R Flag	Number Validated	J Flag	UJ Flag	R Flag	Number Validated	J Flag	UJ Flag	R Flag	Number Validated	J Flag	UJ Flag	R Flag
June/July 1994	2,706	3	173	202	2,660	0	205	25	1,520	32	140	0	N/A	--	--	--
Nov./Dec. 1994	976	0	39	52	923	0	21	0	160	0	7	8	N/A	--	--	--
July/Aug. 1995	504	1	30	16	630	0	18	0	240	3	14	3	N/A	--	--	--
Dec./Jan. 1995/1996	682	1	7	22	840	0	49	17	300	4	8	0	N/A	--	--	--
Sep./Oct. 1997	4,380	8	14	57	N/A	--	--	--	292	0	14	0	73	1	0	0
Jan./Feb. 1998	4,440	9	14	74	N/A	--	--	--	296	0	11	5	74	0	0	0
Total	13,688	22 (0.2%)	277 (2%)	423 (3%)	5053	0 (0%)	293 (6%)	42 (0.8%)	2808	39 (1%)	194 (7%)	16 (0.6%)	147	1 (0.7%)	0 (0%)	0 (0%)

N/A: Not applicable. Analyses not performed.

J: Validation qualifier for estimated result.

UG: Validation qualifier for estimated non-detect.

R: Validation qualifier for rejected data.

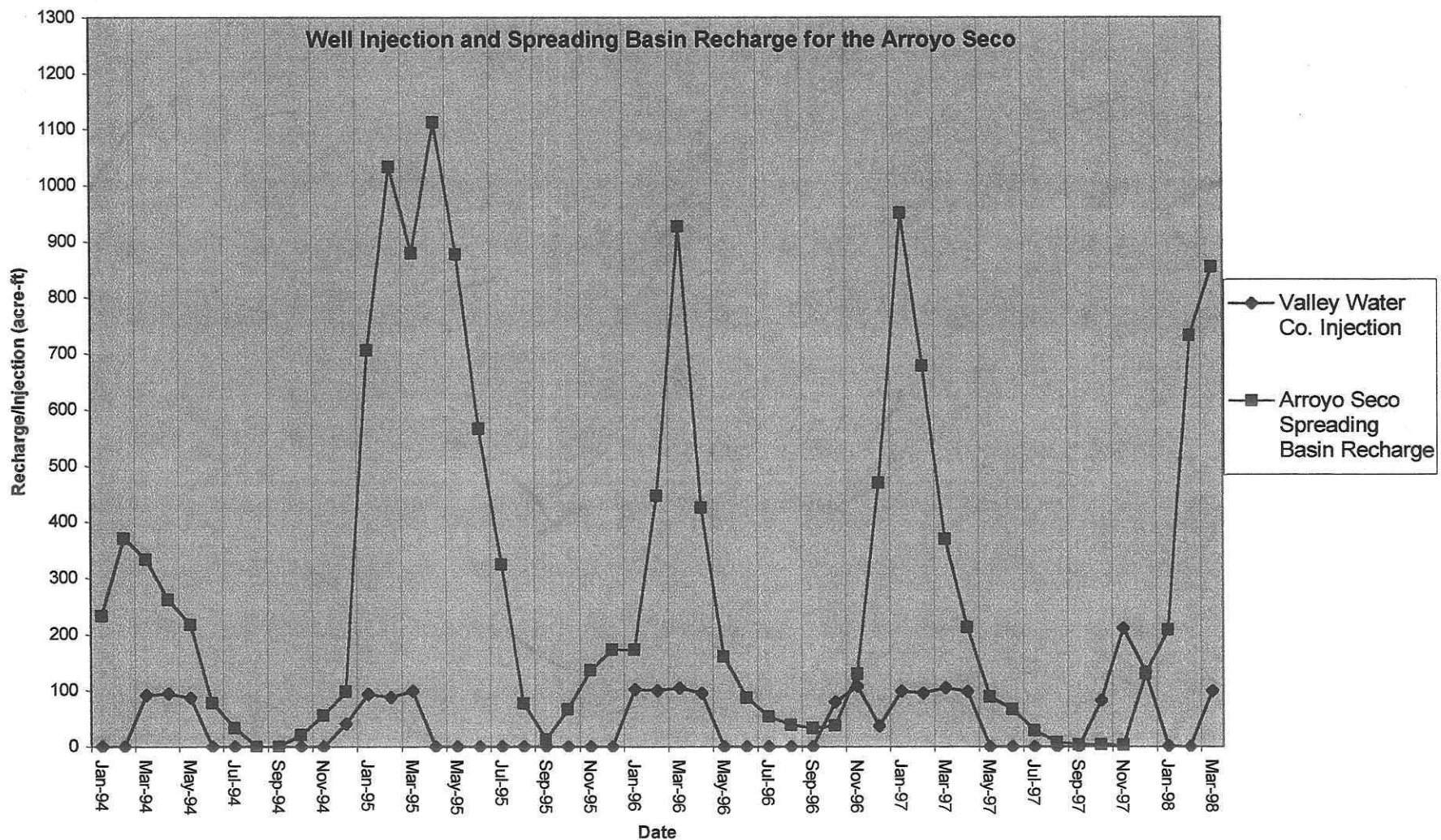


FIGURE 4-1

VOLUMES OF VALLEY WATER COMPANY INJECTION
AND ARROYO SECO SPREADING BASIN RECHARGE

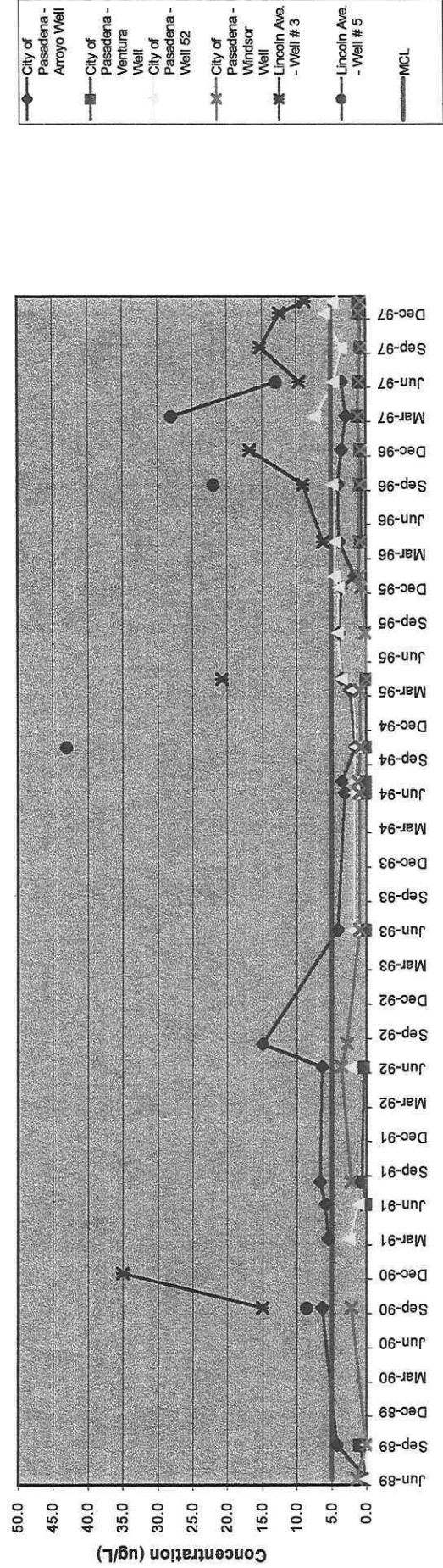
January 1994 - March 1998

Jet Propulsion Laboratory
Pasadena, California

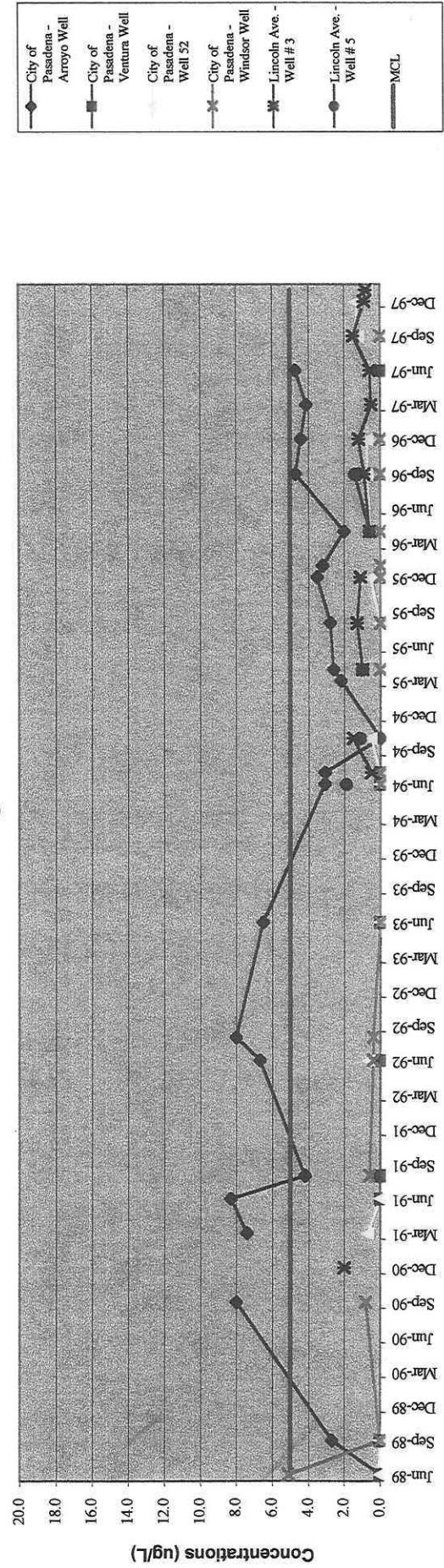


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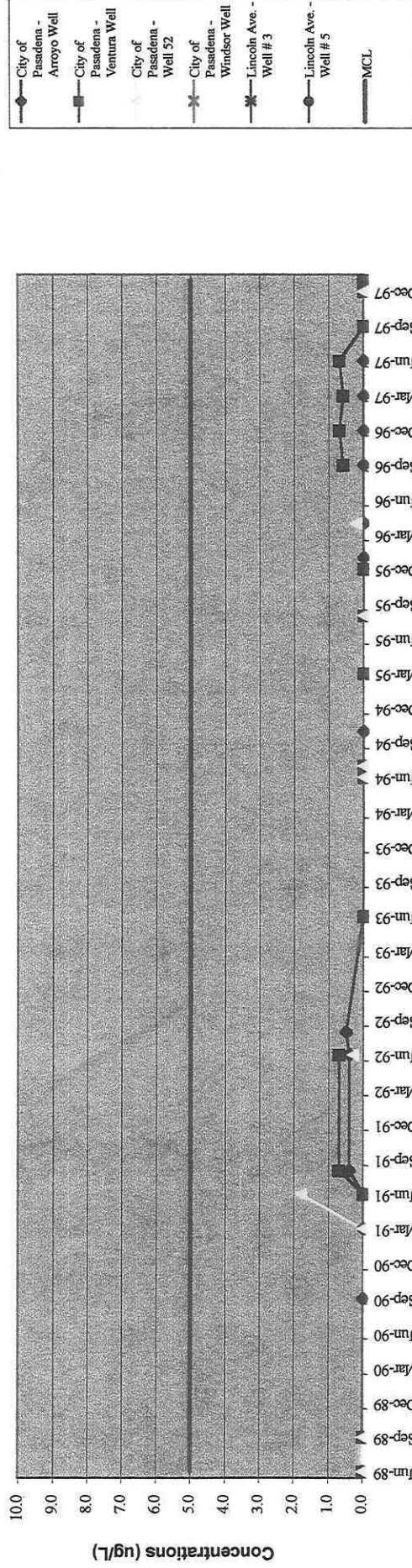
Trichloroethene - Downgradient Production Wells



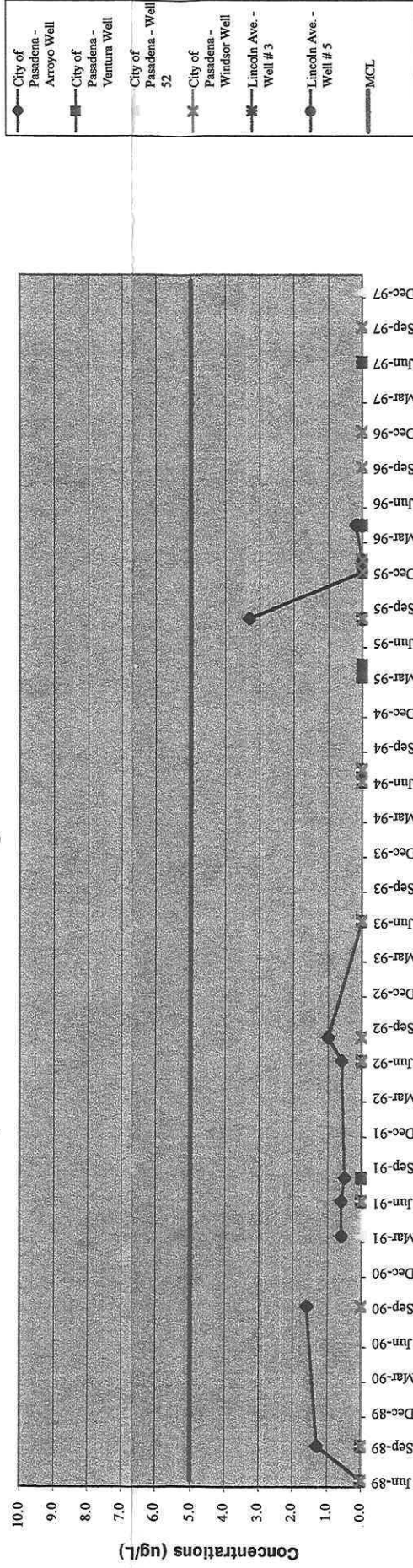
Carbon Tetrachloride - Downgradient Production Wells



Tetrachloroethene - Downgradient Production Wells



1,2-Dichloroethane - Downgradient Production Wells



Date

- Notes: 1. Detection Limit for all compounds is 0.5 ug/L
2. Zero value indicates that result was below detection limit
3. All data obtained from CA DHS computer database. All available data used.
4. MCL: California Maximum Concentration Limit

FIGURE 4-2

HISTORY OF VOC'S OF INTEREST IN
DOWNGRAIENT MUNICIPAL PRODUCTION WELLS
JUNE 1989 - DECEMBER 1997

Jet Propulsion Laboratory
Pasadena, California

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